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UPH30 ULTRA PRECISION GEAR HOBBING MACHINE

with continuous electronic table dividing control, will produce ultra precision gears throughout the life of the machine.

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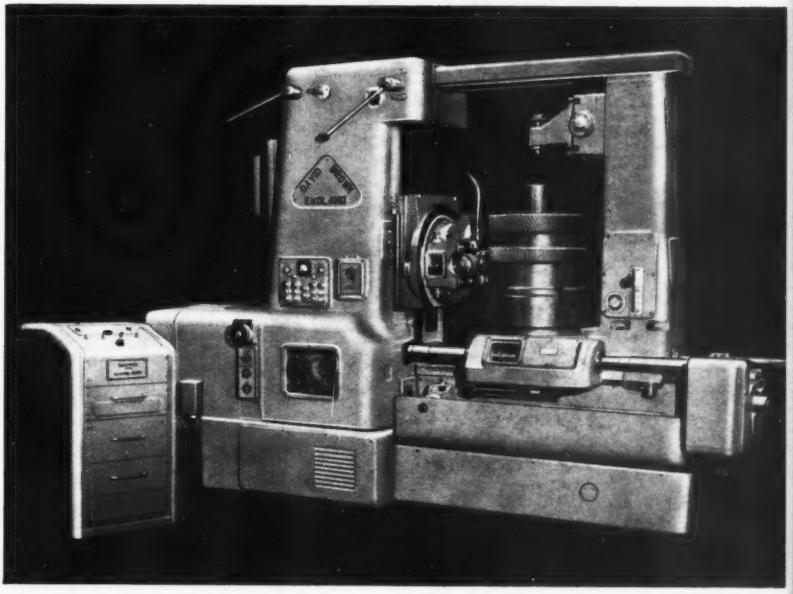

THE DAVID BROWN CORPORATION (SALES) LIMITED

100 YEARS SERVING INDUSTRY 1860-1960

MACHINE TOOL DIVISION, BRITANNIA WORKS, SHERBORNE STREET, MANCHESTER 3. TELEPHONE: BLACKFRIARS 4711

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BRIGHT STEEL BARS

Rounds (drawn, turned and ground)
Hexagons, Squares, Flats,
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Mild, Freecutting, Casehardening,
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Supplied to A.I.D., Admiralty,
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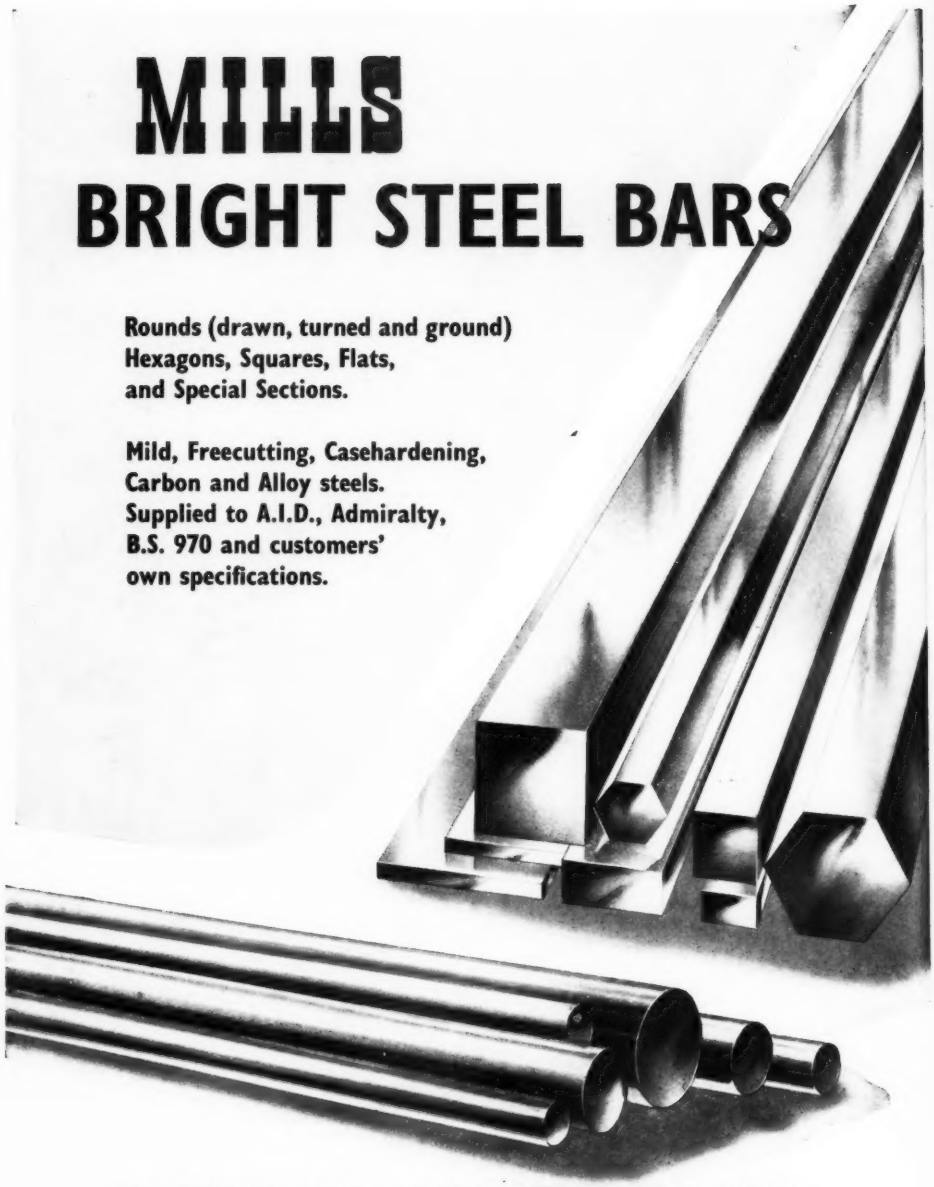

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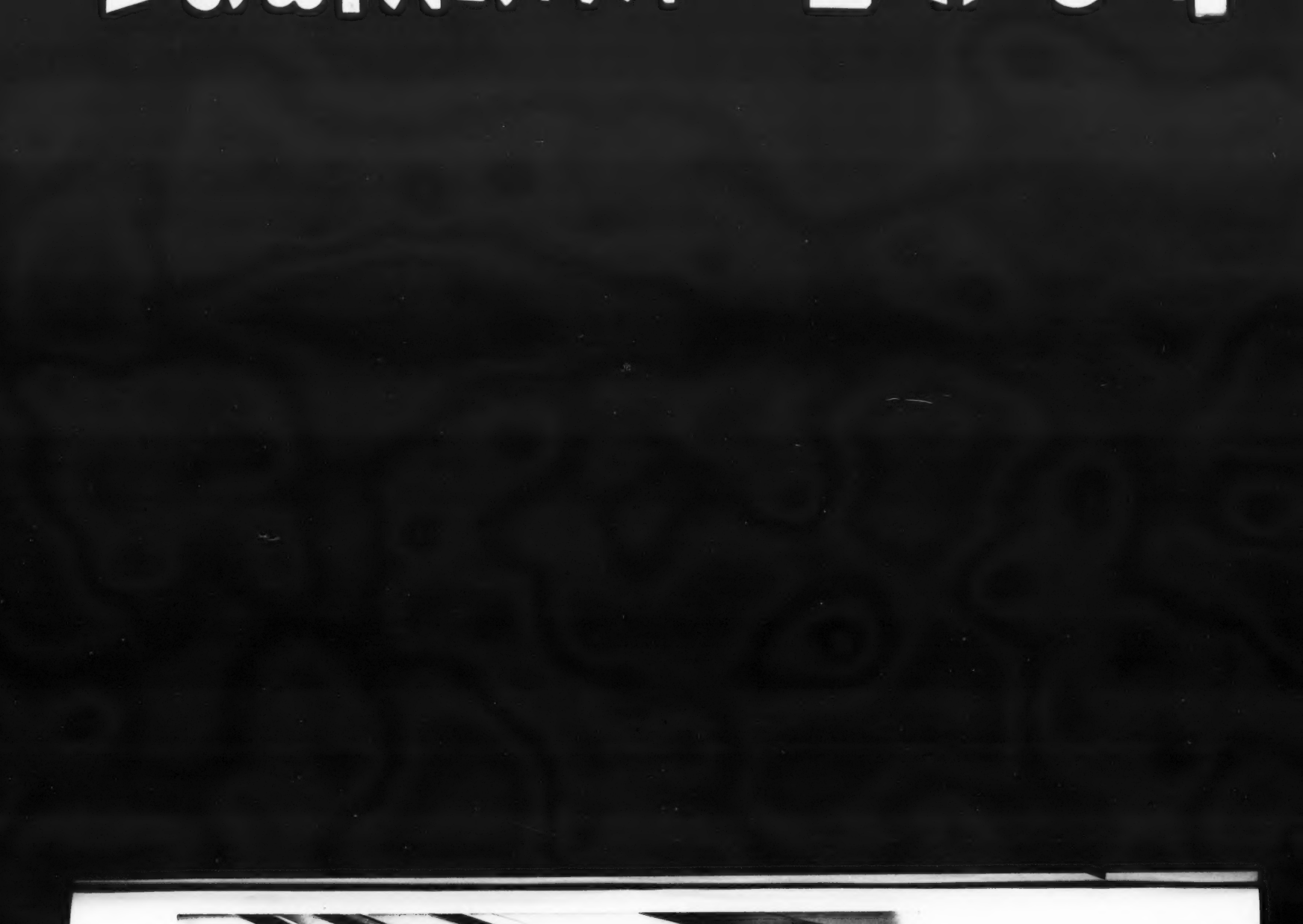

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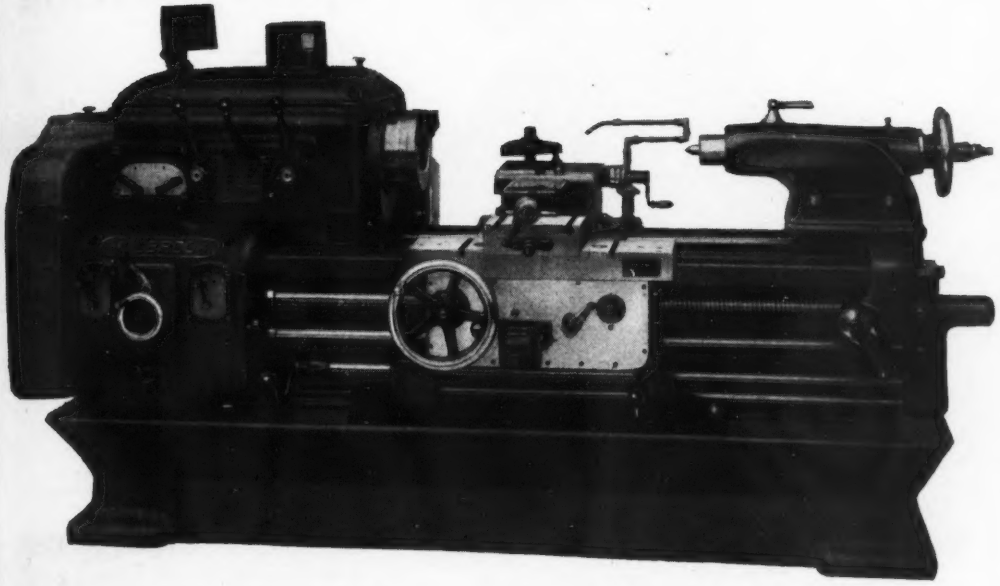
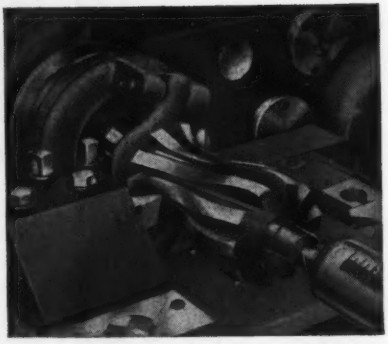
MODEL 'R'

UNIVERSAL RELIEVING LATHES





BUILT IN TWO SIZES, FOR RELIEVING AND GRINDING CUTTERS UP TO 4" AND 9" DIAMETER

FEATURES INCLUDE

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VARIABLE RISE CAM

3 TO 1, QUICK RETURN OF CARRIAGE IN EITHER DIRECTION

REAR OPERATION, FOR LEFT HAND WORK

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CAMBRIDGE ROAD, HARLOW, ESSEX

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Dress in "Crimplene" made from 100% Terylene. By Courtesy of I.C.I. Limited.

Sanderson's Heliocentric Speed Reducing Gears have been chosen by Imperial Chemical Industries Limited to play an important part in the production of 'Terylene' polyester fibre. Gears are installed in I.C.I. plants producing 'Terylene' in Great Britain, and in the many plants manufacturing polyester fibre under licence throughout the world.

Heliocentric may be the answer to your power transmission problems—range of ratios 20:1 to 512,000:1. Horse power 1/6 to 30.

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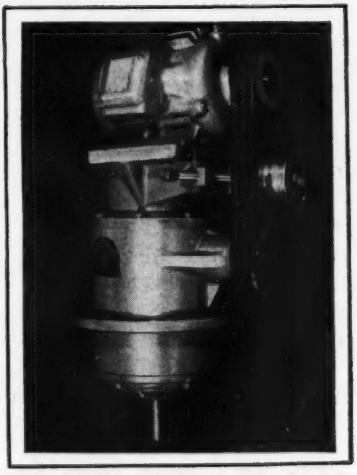

Motorised Heliocentric Speed Reducer, ratio 280:1 designed for synthetic fibre extrusion plant

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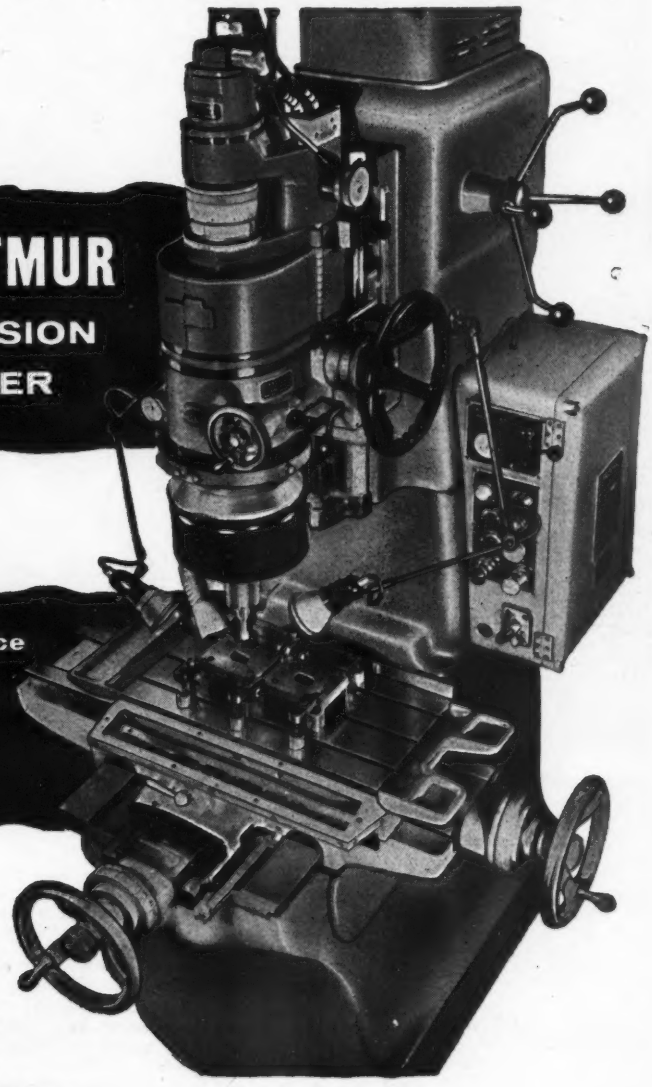
MOORE-CATMUR
No. 2 PRECISION JIG GRINDER

The craftsman's choice for high precision and rapid stock removal.



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NRP 2631

A2

LOOK TO THE FUTURE

THREE-PHASE IS THE FUTURE WELDING TECHNIQUE . . .

. . . and its here **TODAY** to rid you of power supply problems. Balanced load conditions and better than 80% power factor see to that. But more important, Sciaky Patent 'Three-Phase' brings positive welding advantages, ensures consistency of weld quality at a given control setting throughout the longest production run and permits complex electronic programming for welding 'difficult' metals. 'Three-Phase' with its characteristic progressive current rise and inherent lack of skin effect also greatly extends electrode tip life, and the need to stop production for dressing is far less frequent.

The consistency of welding produced by Sciaky Patent 'Three-Phase' is such, that wherever quality and product finish are important—only Sciaky 'Three-Phase' resistance welding machines are seriously considered for top quality results . . . In resistance welding Sciaky Patent 'Three-Phase' takes care of the future . . . **TODAY**

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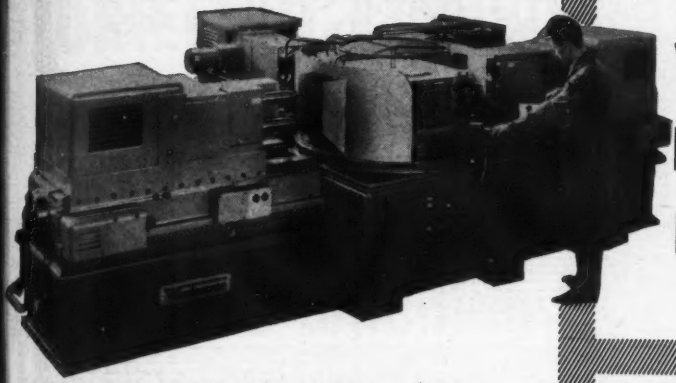

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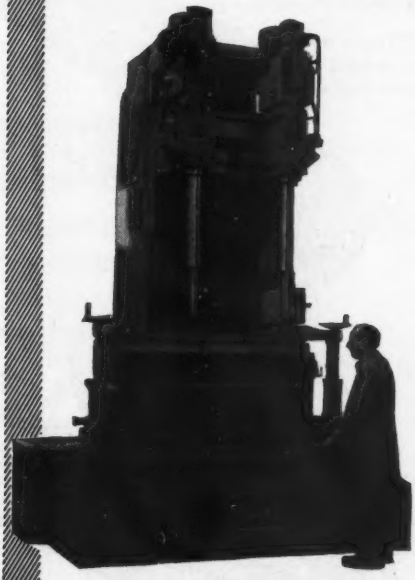
THREE SPINDLE VERTICAL FINE BORER with automatic loading and indexing table. Fine boring piston gudgeon pin holes.



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COBALTCROM ABRASION RESISTING are a special type of blade far superior to all low tungsten types.

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The Steadfast Hacksaw Frame is a new type with shatterproof handle of amber plastic. Adjustable oval tube frame, chromium plated. Packed in a plastic wallet with spare blade.

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J. STEAD & CO. LTD. MANOR WORKS, SHEFFIELD, 2

S159

Now...
DRILLING-BORING -MILLING on *One* Versatile Machine

FRENCH **SAUT-DU-TARN**

VERTICAL SLIDING HEAD DRILLING, BORING, TAPPING AND MILLING MACHINE MODEL J 6c 320

This multi-purpose machine has an extensive selection of speeds and feeds plus an unusually wide range of traverses. Fast approach and automatic return of the spindle head, plus quick-change tool sockets, permit rapid operation. The head slides smoothly on rollers. The 35½" x 14⅛" table has longitudinal and transverse automatic feeds, and when disengaged, the table floats freely on rollers for rapid hand positioning.

SEE THIS MACHINE at our SHOWROOMS

Capacities: 1¼" drilling, 4 1/16" boring in medium C. steel.
Spindle speeds (12) 80 to 2750 r.p.m. Spindle head traverse 19⅝".
Table traverses: 15¾" long., 9⅞" trans., 14⅞" vertical.

Send for illustrated brochure M/189.

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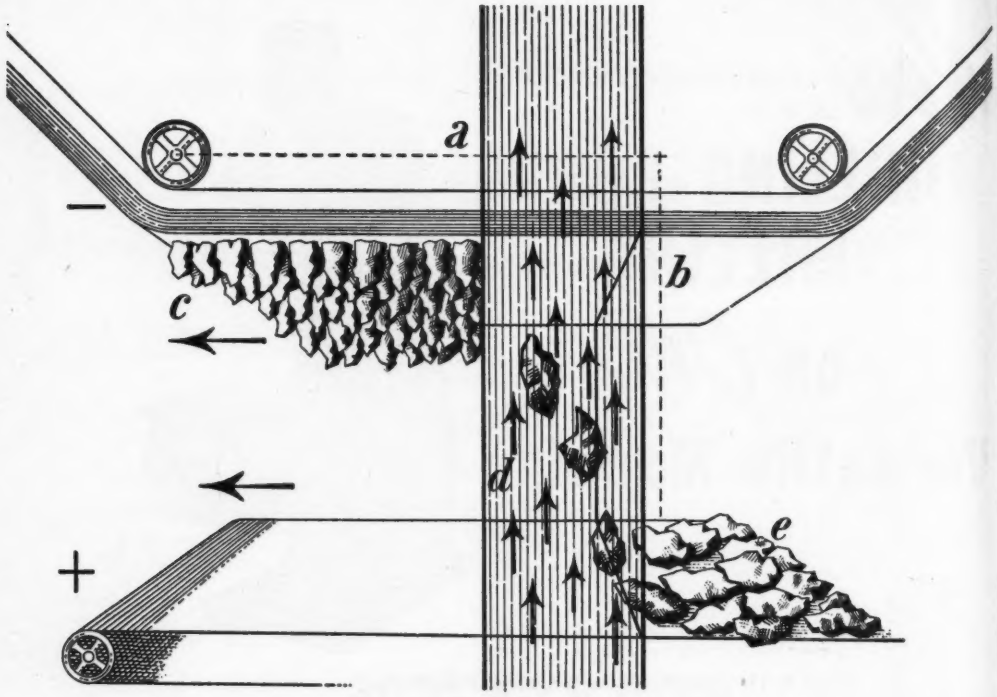

a cut above the rest?

YES a million cuts! And here's why

Every razor-edged grain in EAC abrasives stands bolt upright, presenting maximum cutting power to the work in hand. The grit, orientated on its longitudinal axis, is shot arrow-like into the adhesive by electrostatic force. That's why EAC abrasives literally bristle with cutting edges, work faster and last longer than ordinary makes. There's the right EAC abrasive for every operation. Insist on EAC for the best of good reasons—it saves money!

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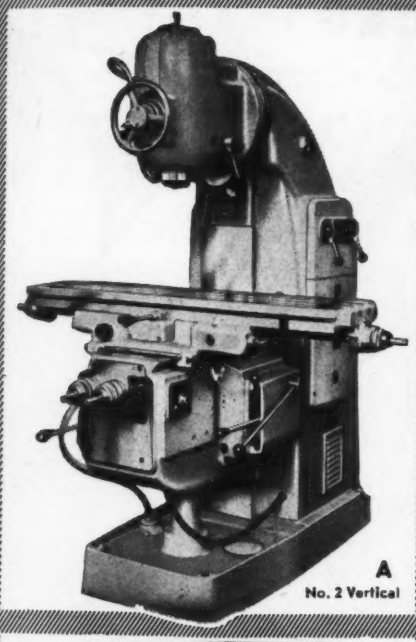
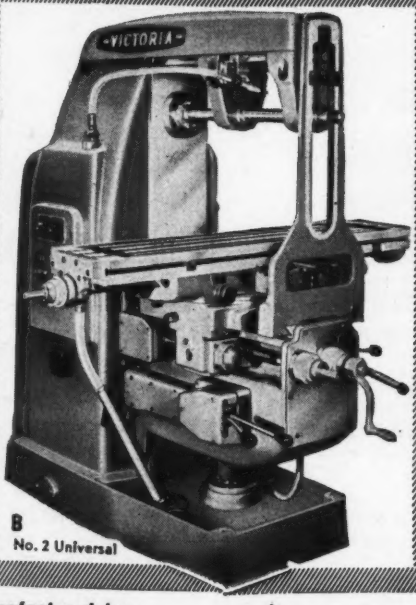


A
No. 2 Vertical



B
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Ahead of the Field . . . . . .

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VICTORIA

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MILLING MACHINES

- ★ **48" x 11⅛" Table**
- ★ **32" Longitudinal Traverse**
- ★ **Power Feeds and Rapid Traverse in all directions**
- ★ **12 Spindle Speeds 30-1050 r.p.m.**
- ★ **18 Table Feeds 0.65-15 in./min.**
- ★ **5 h.p. motor**
- ★ **Backlash Eliminator Standard Equipment**

PRICES

A £1830 Including 3-phase electrics

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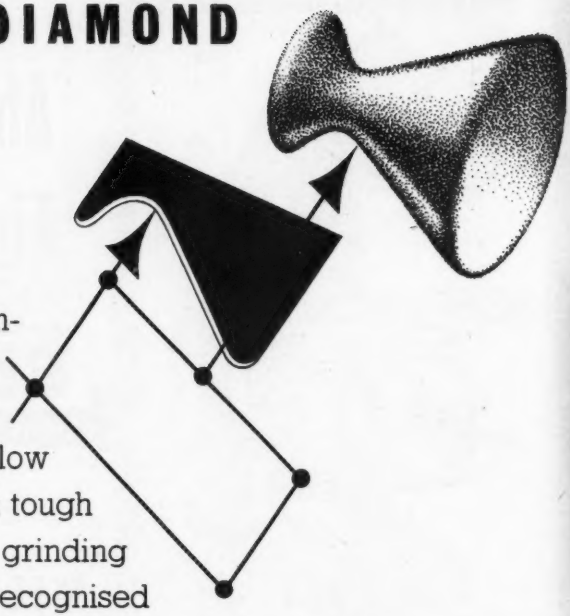
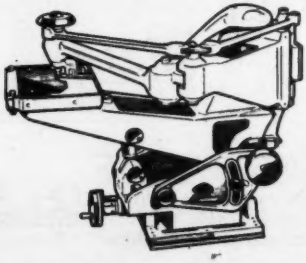
KNOW YOUR DIAMOND

Form grinding



Where a smooth dimensionally precise finish is required on a complex shape, machining can be slow and costly, particularly if a tough material is involved. Form grinding is becoming increasingly recognised as the best method in many cases. It can provide the necessary accuracy and finish, and the absence of pre-shaping saves time. However, that accuracy depends entirely on the grinding wheel, so we have evolved equipment for the precise, speedy forming and dressing of form grinding wheels, using a template of the shape required, a pantograph and diamond tipped tools. The template is five or ten times the true size, to minimise inaccuracies; the pantograph provides faithful scaling down, and the diamond makes light of the work of shaping the wheel.



Data sheets available

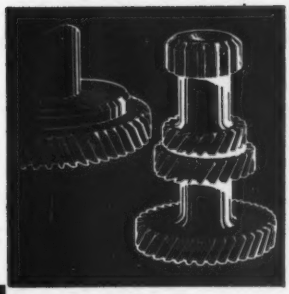
L.M. VAN MOPPES & SONS (DIAMOND TOOLS) LTD
BASINGSTOKE · HAMPSHIRE · ENGLAND

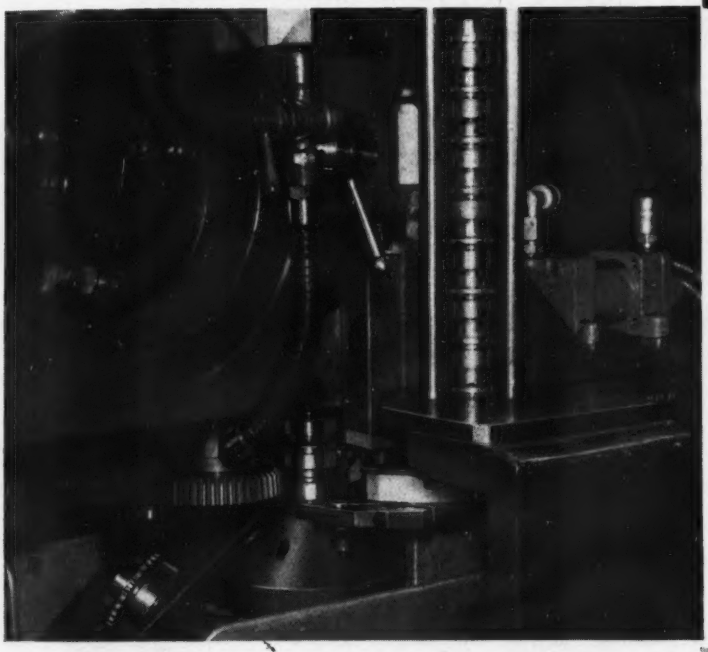
TELEPHONE: BASINGSTOKE 1240 · TELEGRAMS: DIATIPT, BASINGSTOKE

high-speed shaping of spur and helical gears on the British-made

FELLOWS-ENGLAND

TYPE 7125A GEAR SHAPER





SPUR GEARS

External up to 10" P.D. at 6 D.P.

Internal up to 6" P.D. at 6 D.P.

HELICAL GEARS

External up to 7" P.D. at 6 D.P.

Internal up to 6" P.D. at 6 D.P.

Helix Angles from 5° to 45°

RANGE OF CUTTING SPEEDS

6 speeds from 156 to 515 strokes per min.

CUTTER FEEDS PER STROKE

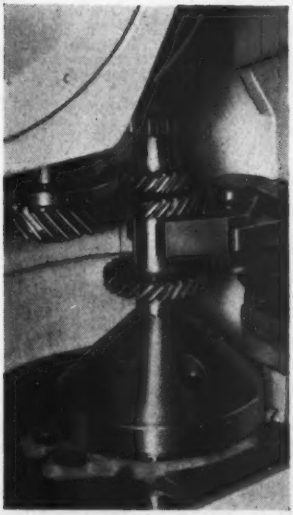
Eight feeds from .006" to .0012" per inch dia. of cutter

A fully-automatic cycle can now be obtained on the Fellows-England Type 7125A Gear Shaper, for suitable gears. Repetitive accuracy in locating and clamping, is assured.

The above illustration shows the principle applied to cutting a 30T, 12 D.P. 0·16" face width, spur gear whilst alongside, a layshaft cluster gear, the 2nd speed gear of which is cut in a cycle time of 3 minutes 4 seconds. The latter employs a transfer arm which loads and unloads from a conveyor which is part of a 27-station in-line transfer machine.

The Fellows-England Type 6 A.H. Gear Shaper, cuts gears up to 20" (external), and 18" (internal) pitch diameter, up to 3/4 (spur) 4/5 (helical) D.P., maximum face width 5".

The PATENTED FEED CAM TRIP MECHANISM fitted to Fellows-England Machines allows accurate control of cutter over-run to avoid dropped-tooth production.

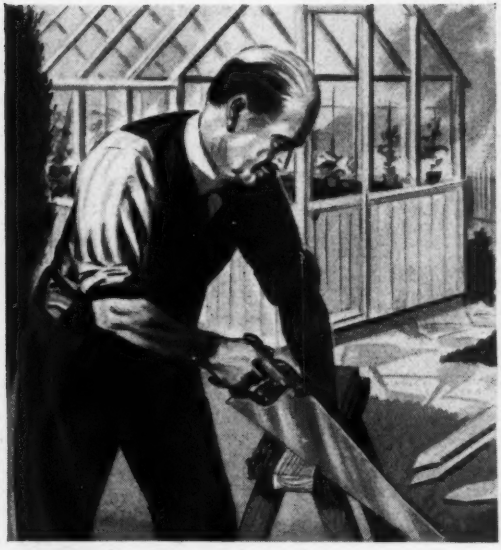


ALFRED HERBERT LTD., COVENTRY

AD 620

Weekends
it's important to this do-it-yourself enthusiast that he has the best tools he can buy— Spear & Jackson of course!

Weekdays
it's important to him as a production engineer to use the best tool steel for the job—to him, that means Spear and Jackson again!



Spear & Jackson not only make superb woodworking and garden tools — they make a range of tool steels too! With a background of 200 years of making steel for fine saws, it's not surprising that these tool steels should rate so high in their classes. If you're looking for consistent quality in tool steel, specify Spear steels—you won't be disappointed! Data sheets available on request.

SPEAR & JACKSON ***TOOL STEELS TO TRUST***

Other products include : *Segmental Saws . Hot Saws . Friction Saws Hacksaws . Metal Cutting Bandsaws . Fusion Bands . Tungsten Carbide Tipped Saws and Cutters . Machine Knives . Ground Flat Stock*

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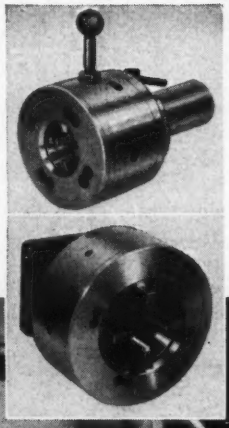
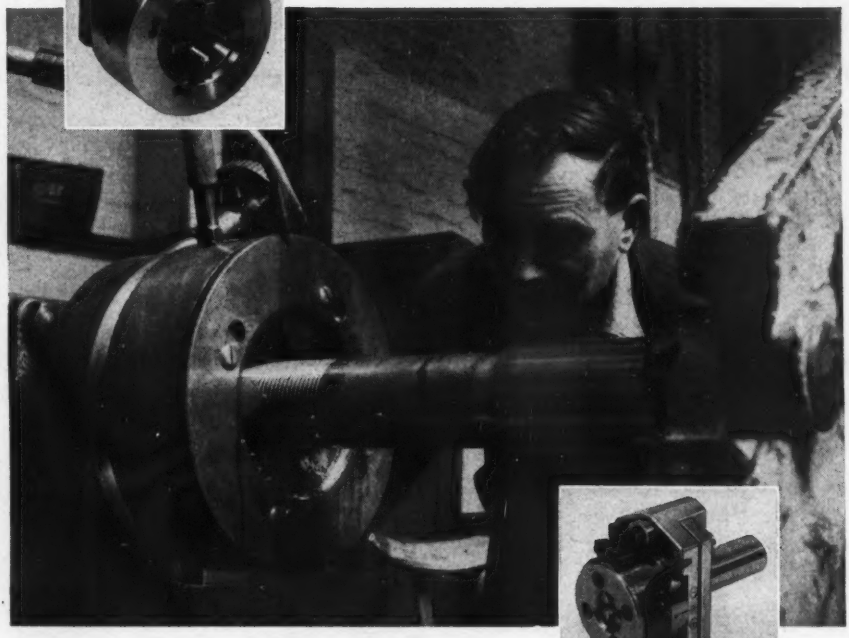
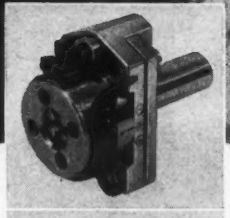
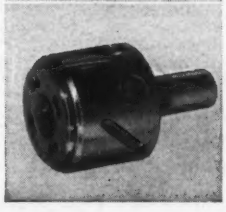


the world's finest threading equipment —

COVENTRY DIEHEADS







A supreme range without equal; foremost in its field for nearly sixty years. Types available for rapid production; for use on spindles subject to rapid indexing; for use on stationary spindles and revolving spindles, with or without reverse; for cutting parallel or taper, short or long threads.

Self-opening Dieheads, 13 sizes, ¼" to 4½". Rotating Self-opening Dieheads, 11 sizes, ¼" to 3½". Solid Adjustable Dieheads, 8 sizes, ¼" to 3½".

1500 sizes and types of dies for cutting from commercial to precision threads, from the finest to coarsest pitch, standard or special forms, in all materials that can be threaded.

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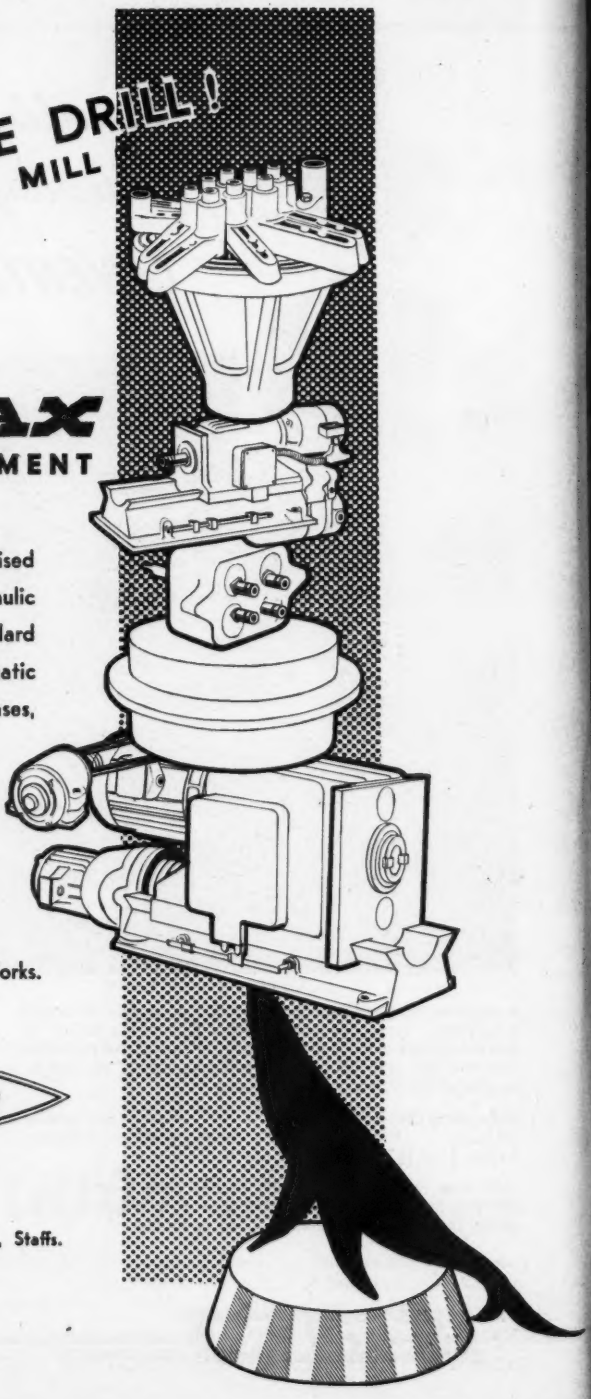
REAM TAP BORE & MILL

DRILLMAX
AUTOMATIC EQUIPMENT



includes a unique range of Standardised Units — Screw Feed, Cam and Hydraulic Unit Heads, Multi-Drill Heads and Standard Drill Spindles and Gearing — Automatic Rotary Indexing Tables, Wing Bases, Columns, Loading and Unloading Mechanisms, etc., from which complete Automatic Rotary, Drum and In-Line Transfer Special Purpose Machines can be built.

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DRILLMAX DIVISION

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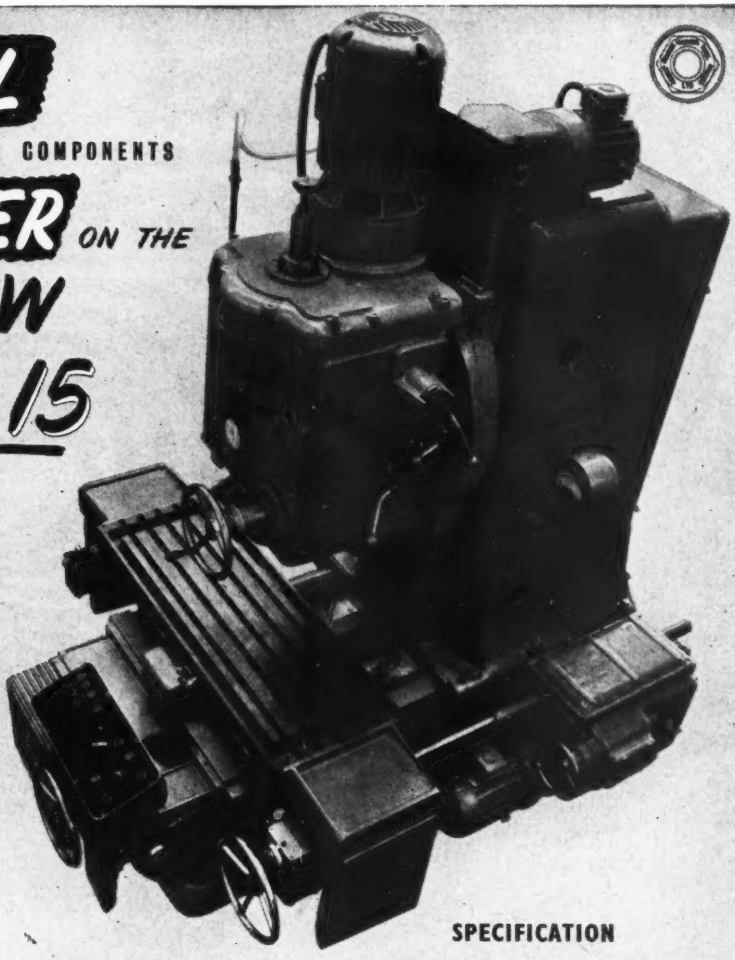
MILL

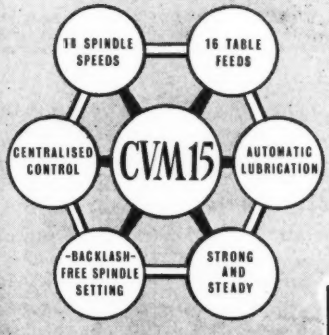
THOSE SMALLER COMPONENTS

FASTER ON THE NEW CVM 15



OPTIONAL EXTRAS

- SWIVEL MILLING HEAD
- POWER TRAVERSE TO SPINDLE
- BORING FEEDS TO SPINDLE
- RETRACTION OF SPINDLE
- INFINITELY VARIABLE FEEDS
- CYCLE MILLING
- TWO-DIMENSIONAL PROFILING
- AUXILIARY CIRCULAR TABLES
- SIDE MILLING MANDREL AND SUPPORT
- DIAL GAUGES FOR BORING



SPECIFICATION

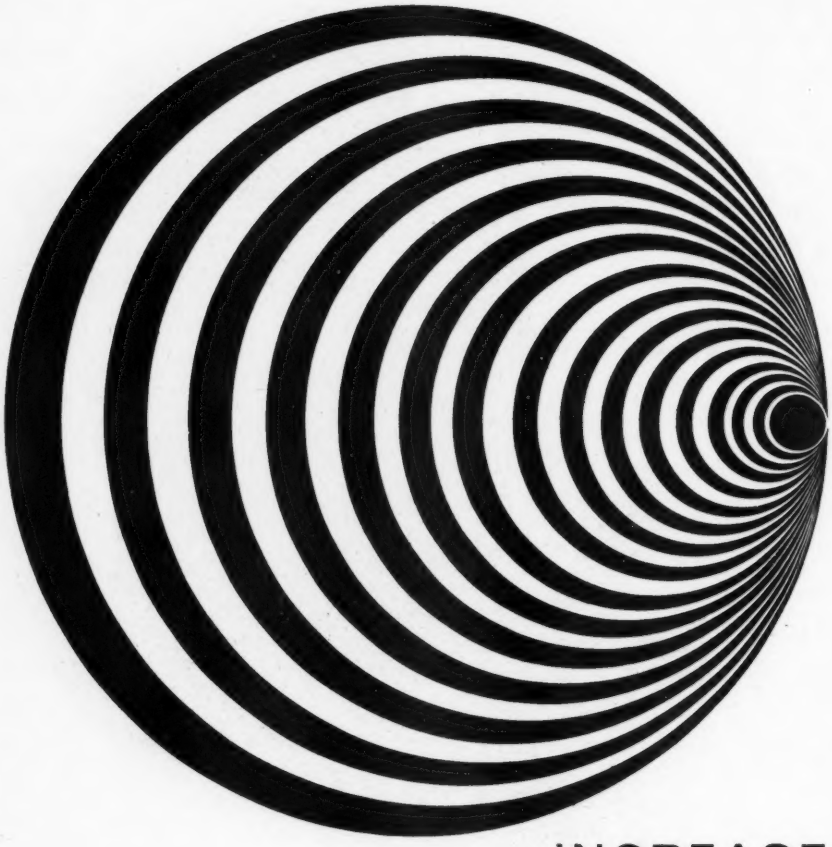
WORKING SURFACE OF TABLE	54 in. x 16 in.
HEIGHT ADMITTED BETWEEN SPINDLE NOSE & TABLE	MIN. 1½ in. MAX. 24 in.
DISTANCE FROM CENTRE OF SPINDLE TO FACE OF COLUMN	18 in.
SPINDLE ADJUSTMENT	6 in.
SPINDLE DRIVING MOTOR	10 h.p.
SPINDLE SPEEDS: up to 1600 r.p.m.	
THREE OPTIONAL RANGES OF 18 SPEEDS	
RANGE 1.	20 TO 1000 r.p.m.
RANGE 2.	25 TO 1250 r.p.m.
RANGE 3.	32 TO 1600 r.p.m.
TABLE FEEDS: up to	63 ins./min.
FOUR OPTIONAL RANGES OF 16 FEEDS	
RANGE 1.	0·8 TO 25 ins./min.
RANGE 2.	1·18 TO 37·5 ins./min.
RANGE 3.	1·6 TO 50 ins./min.
RANGE 4.	2 TO 63 ins./min.
TABLE RAPID TRAVERSE	100 ins./min.

FOR FULL DETAILS WRITE TO

KENDALL & GENT

Phone EAST 3282 GORTON MANCHESTER

K249



INCREASE
YOUR
PRODUCTION
CAPACITY

Automatic or semi-automatic machinery increases production and reduces costs, and Martonair pneumatic equipment has been the means of building thousands of machines. Low cost, adaptability and simplicity are special features of Martonair products. If there is no machine available for the operation you wish to mechanise, or existing machines are for some reason unsuitable, it may well be possible to build a simple special purpose machine. The Martonair Technical Service is at your disposal at all times, and has considerable experience of the applications of pneumatics in industry.

Martonair

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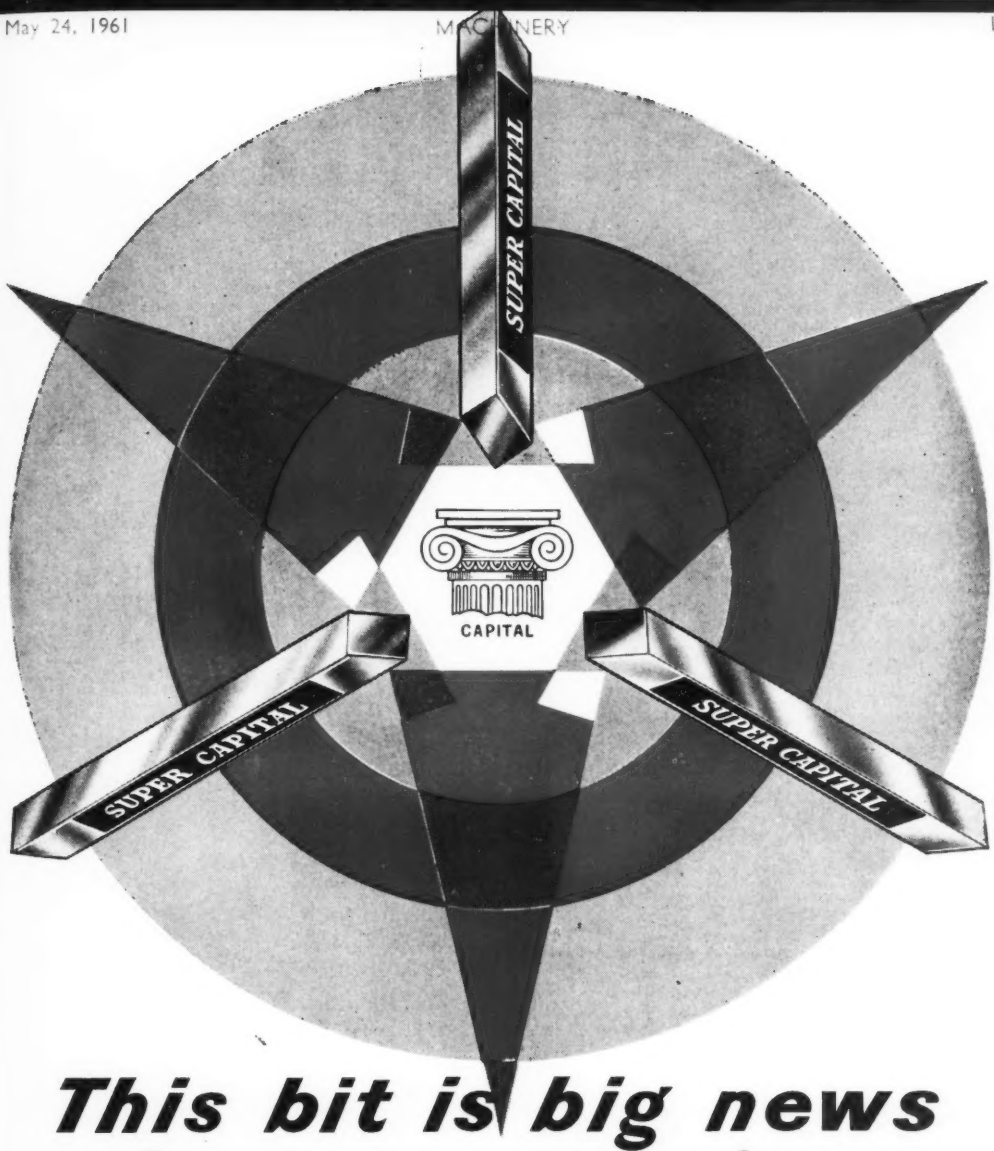


This bit is big news
—from any point of view

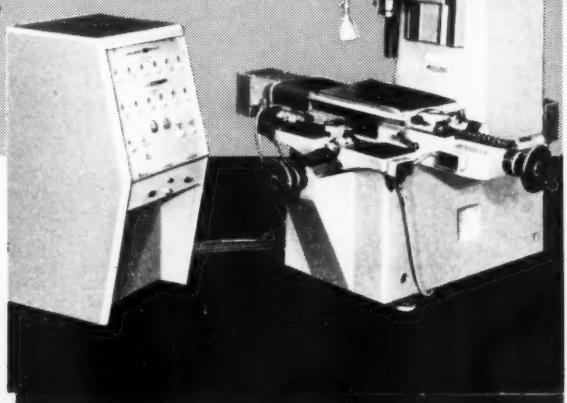
There are sound reasons for using "Super Capital" High Speed Steel Toolbits. The high quality steel is production controlled and tested, in Balfour's own works, from the melt to the finished product. Toolbits are subjected to a specialised heat treatment to ensure extra life and durability. They satisfy the needs of users who require maximum performance at no extra cost. These qualities ensure that a change to "Super Capital" is a change for the best. *Available in Sheffield, and also from branch office stocks in London, Birmingham, Manchester, Cardiff and Glasgow.*

ARTHUR BALFOUR

ARTHUR BALFOUR & CO, LTD. CAPITAL STEEL WORKS, SHEFFIELD ENGLAND.
ASSOCIATED COMPANY: THE EAGLE & GLOBE STEEL CO, LTD.

AIRMEC AUTOSET

Gets those Drilling Jobs taped



AUTOMATIC PRECISION DRILLING (LARGE SCALE OR SMALL) WITH THE AIRMEC AUTOSET

POSITIONS THE WORK
AUTOSET automatic co-ordinate setting equipment provides accurate automatic control of the lead screws of a co-ordinate table. It enables the table to be positioned automatically by means of a punched tape (containing co-ordinate information for up to 400 operations) or manually by means of a series of knobs and dials.

SELECTS THE RIGHT TOOL
Facilities are provided for selecting one of up to ten tools and for controlling a large number of other variables such as tool rates, feed depths and spindle speeds.

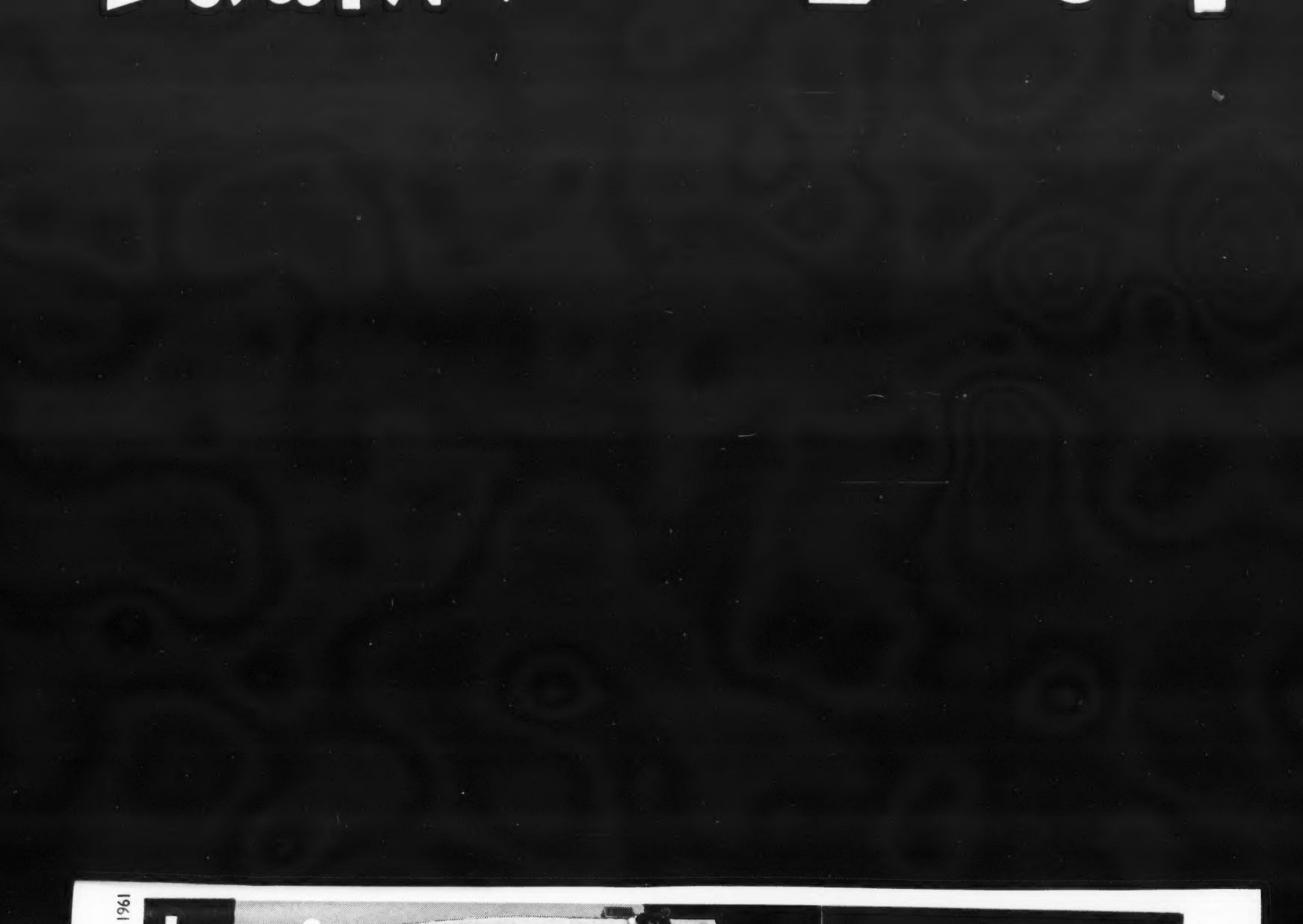
CUTS OUT ERRORS
Autoset is highly accurate—automatic compensation is provided for table backlash and cumulative lead screw errors.

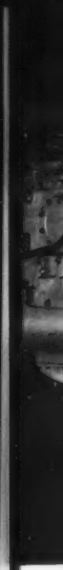
CUTS THE COST
A complete equipment for automatic control in two dimensions costs only £1,500. Manual control considerably less.

ROBUST AND RELIABLE
No electronic valves used.

EASY MAINTENANCE
Autoset has been designed for trouble-free service and easy maintenance.

Airmec





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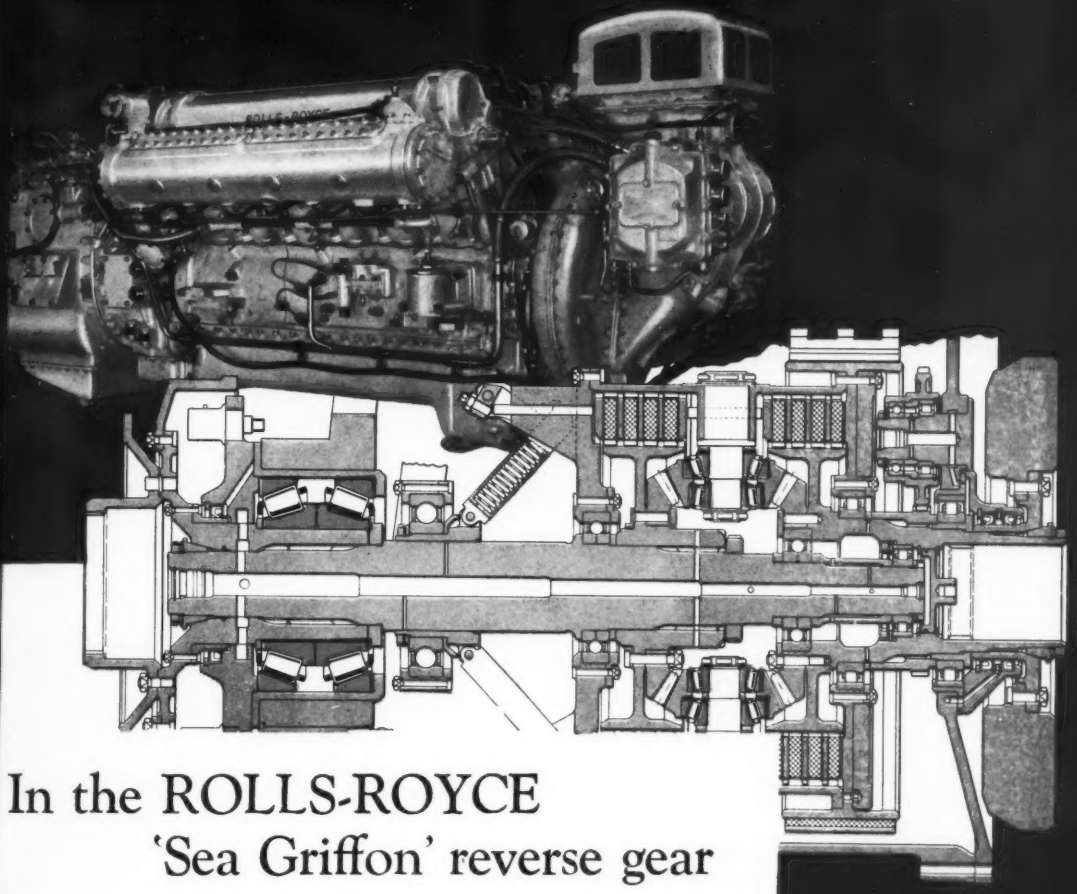

In the ROLLS-ROYCE 'Sea Griffon' reverse gear

The drawing shows the reverse gear for the powerful Sea Griffon engine shown in the background. As will be seen, the reverse gear is of the bevel gear type, the intermediate pinions being carried on Timken bearings mounted on inwardly projecting stubs.

In neutral, the multiple disc clutch and the band brake are both released. For forward drive, the multiple disc clutch is engaged through the toggle action of telescopic struts containing cushion springs.

For reverse, the clutch is released and the band brake engaged. The large Timken bearings take the main propeller thrust; they also support and end-locate the main shaft. An internal-expanding brake outside the gear box is used to arrest spin of the main shaft, both due to its own momentum and the overdrive effect from the propeller.

British Timken, Duston, Northampton, Division of The Timken Roller Bearing Company. Timken bearings manufactured in England, Australia, Brazil, Canada, France and U.S.A.

TIMKEN®

REGISTERED TRADE-MARK

tapered roller bearings

Dual control stations enable a single operator to perform sizing adjustments on throughfeed operations at either front or rear.

CINCINNATI

CENTRELESS

* *EXCLUSIVE TO CINCINNATI...*
AUTOMATIC GRINDING WHEEL BALANCING

—provides simple (single lever), fast (20 seconds) and precise balancing whenever required.

* *EXCLUSIVE TO CINCINNATI...*
"FILMATIC" GRINDING WHEEL SPINDLE BEARINGS

—require no maintenance, repair or replacement during lifetime of machine.

- Control station at both front and rear.
- No obstruction between operator and between-wheels working area at rear operating position.
- Plain or ball type regulating wheel slides.
- Infinitely variable regulating wheel speeds.
- Rapid correction of workpiece taper without disturbing set-up.
- Micrometer-type infeed handwheels graduated in 0.00002"
- Centrally grouped controls for ease of operation and maximum efficiency.

Write now for full specification—
Catalogue G-727

CINCINNATI MILLING MACHINES LIMITED

Announcing a new machine incorporating features to reduce operating costs through higher production, increased accuracy and greater ease of operation

220-8 Centuramic GRINDER

Max. work dia — $4\frac{3}{4}$"
Grinding Wheel —
size — 8" wide (max)
x 20" dia. (max)
drive — 20 h.p.

Recessed bed permits operator to stand *close* to machine for maximum working convenience.

BIRMINGHAM 24

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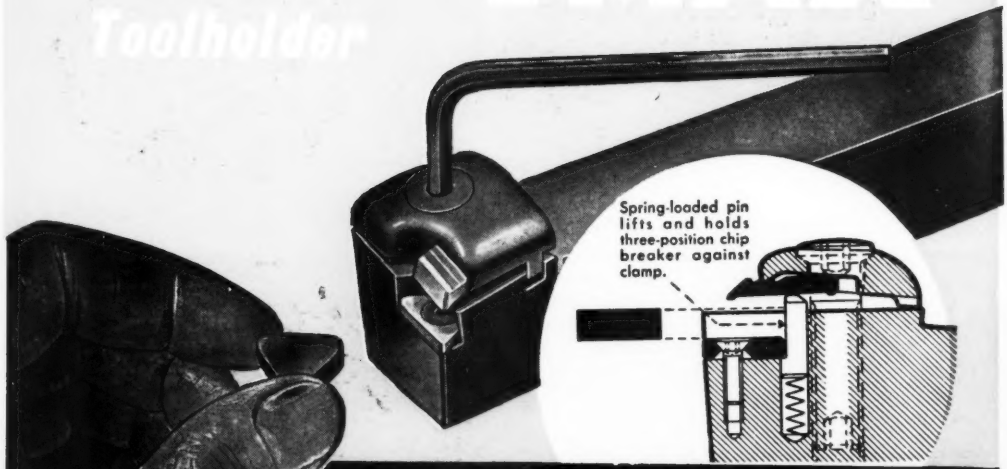
Coromant

The Fastest-Changing Toolholder

T-MAX



With the EXCLUSIVE Spring Lifted Three Step Chipbreaker

Puts a new insert at your fingertips. Calibrated slot shows remaining inserts.

SEND FOR NEW FREE BOOKLET

Covering various T-Max styles and other technical data.

Loosen, change, tighten—and you're back in production. It's as quick and easy as that with Coromant T-Max—fastest throwaway-type, carbide toolholder on the market.

Only T-Max enables you to change either or both the carbide cutting edge and depth of cut without removing or replacing chip breaker.

When set screw is loosened, a spring-loaded pin automatically lifts and holds chipbreaker against clamp—lets you change or index insert with no waste motion. When changing cut, a push with the wrench clicks the solid carbide chipbreaker into desired position for light, medium or heavy cut.

- Precision-made recess seats insert accurately—ensures machining precision.
- No protruding parts—two or more holders easily clamped together.
- Shank of heat treated alloy steel holder - Rockwell Hardness C50, guards against damage. Special SR treated, anti-rust finish.
- Precision cast, alloy steel clamp is streamlined for free chip flow.
- Low cost chipbreaker cuts replacement expense.

SANDVIK SWEDISH STEELS LTD.,
MANOR LANE, HALESOWEN, BIRMINGHAM
Telephone: Halesowen 2121 (7 lines).

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UNIVERSAL MACHINE VICES AND COMPOUND ANGLE TABLES FOR ALL ACCURATE WORK

Suitable for jig boring, grinding, milling and shaping machines. Movements are fully indexed through 360° in the horizontal plane and 90° in the vertical. Any combination of angles can be obtained.

Available with 4" and 6" jaw widths. Accurately indexed for angular work with spot sight and knife edge for register. Note the clean design, low height and rigid mounting. Angles cannot alter once the clamps have been locked.

Universal table fitted with interchangeable table. Changeover from circular to rectangular table is readily effected by loosening clamping bolts.
Available in two sizes. Circular 6" and 8" diameter. Rectangular 8" x 6" and 10" x 8".

ABWOOD

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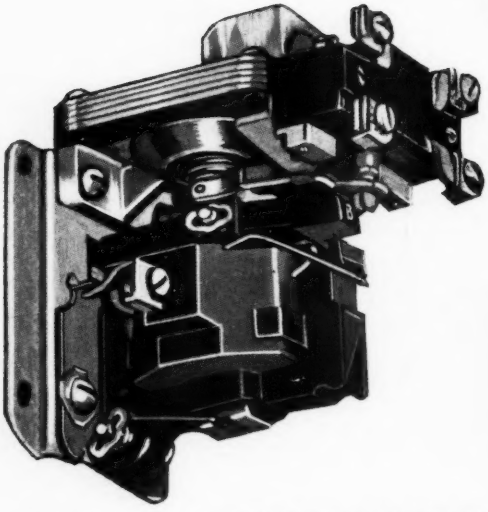
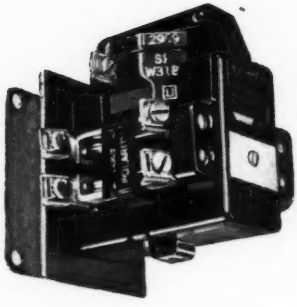
YET AGAIN SQUARE D LEADS... NOW a





CLASS 9050
TYPE AO-1E
TIMING RELAY

THESE 2 UNITS ARE THE BASIS FOR A COMPLETE RELAY SYSTEM

CLASS 8501
TYPE DO-22
RELAY

HERE'S WHY DESIGNERS AND USERS ALIKE PREFER SQUARE D

Complete selection. Relays available for both AC and DC systems—with up to 10 contacts—in both electrically and mechanically held forms. Timing relays with intervals from 0.2 seconds to 3.0 minutes—also in AC and DC versions. Require less panel space. Relays are only 3in. wide, range in height from 3¼in. to 5in. Timers are just 2⅝in. x 4¾in. or 2¼in. by 7¾in. Mechanically held relays require no extra panel space. No mounting problems. All Type D relays and Type A timers have identical mounting hole dimensions. Easy wiring. Pressure wire connectors. Long life. Balanced construction with single moving part increases life. Epoxy-resin moulded coil operates cooler, virtually eliminates coil burnout.

LEADERS IN CONTROL GEAR FOR OVER 50 YEARS

SQUARE D LIMITED

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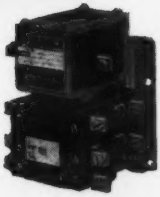
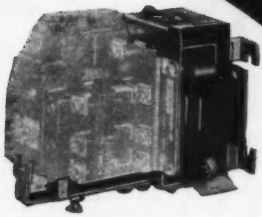
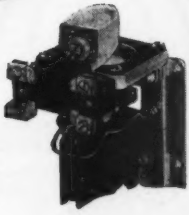


DC relays have mounting dimensions and contact arrangements identical to AC relays

Square D Type D A.C. relays available with up to 10 contacts



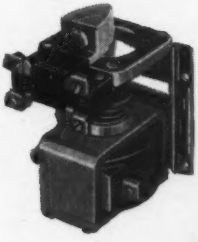
Easy-to-use attachment converts any Type D relay to mechanically held with no increase in panel space



NEW timer

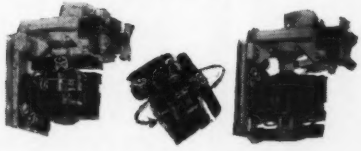
Timing relays have same mounting dimensions as Type D relays

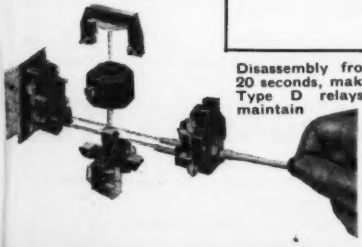
A FURTHER ADDITION TO THE SQUARE D RELAY FAMILY



Matching DC timing relays

Both AC and DC versions convertible from on-delay to off-delay, using only a screwdriver





Disassembly from front in 20 seconds, makes Square D Type D relays easiet to maintain

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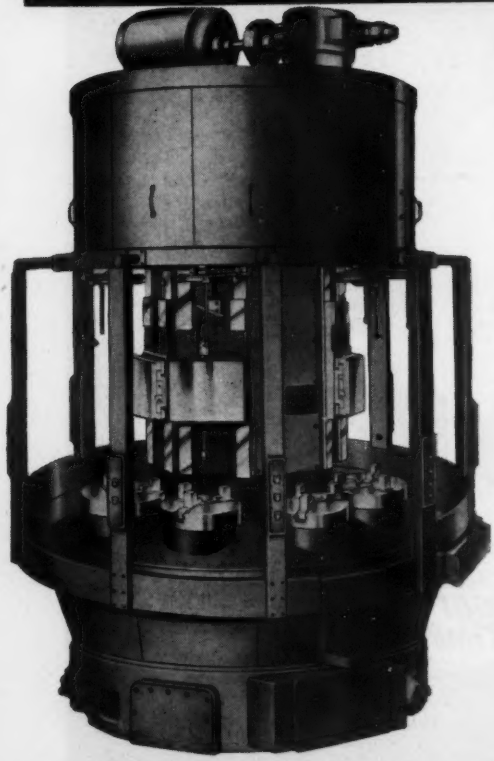
To have the best Specify Square D

NOW BULLARD PRICED LOWER!



NEW Bullard Mult-Au-Matic Type "M"

Contrary to the general upward trend in the cost of new plant production equipment, The Bullard Company is offering the *new* Type "M" Mult-Au-Matic at a price which is *lower than competitive methods.*

Designed and built according to exacting Bullard standards, the *new* Type "M" Mult-Au-Matic incorporates many new features of rigidity, accuracy and productivity which have made this machine famous the world over.

For full details write to Sole Agents in the U.K

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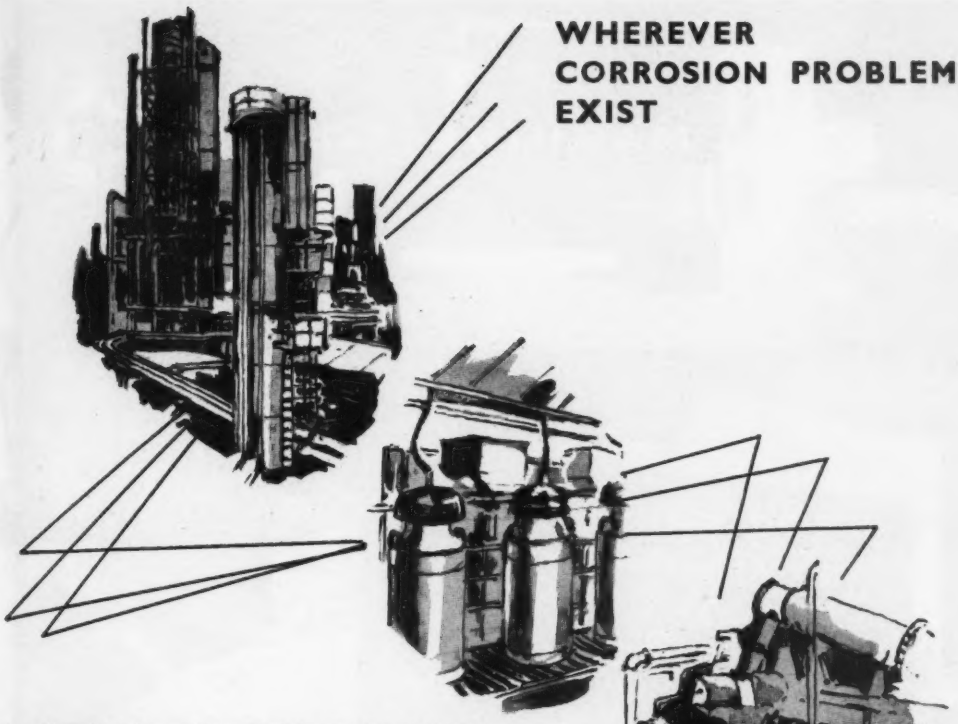
WHEREVER CORROSION PROBLEMS EXIST



Low Moor Stainless and Heat Resisting Steels have proved to be the answer to numerous industrial applications, where the problems of attack by corrosion at high temperatures are encountered.

Each and every industrial and engineering application demands its own specific type of Stainless Steel, and Low Moor Alloy Steelworks manufacture a complete range of specifications to meet *your* individual requirements.

Over a considerable number of years LOW MOOR Stainless and Heat Resisting Steels have achieved a high reputation for quality and consistency, and the wealth of technical knowledge and experience which has been gained in this field is always available to our customers.

A full range of specifications is regularly produced to satisfy both commercial requirements and also comply with A.I.D. and A.R.B. conditions of release.

For details of Alloy and Special Steels and Super Hiperm, contact LOW MOOR ALLOY STEELWORKS LIMITED.

For Extrusions, contact LOW MOOR FINE STEELS LIMITED

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LOW MOOR, BRADFORD. Tel: BRADFORD 77331 (9 lines)

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PROCUNIER
the world's finest
TAPPING
EQUIPMENT
NOW AVAILABLE IN GREAT BRITAIN
• Precision built to highest standards.
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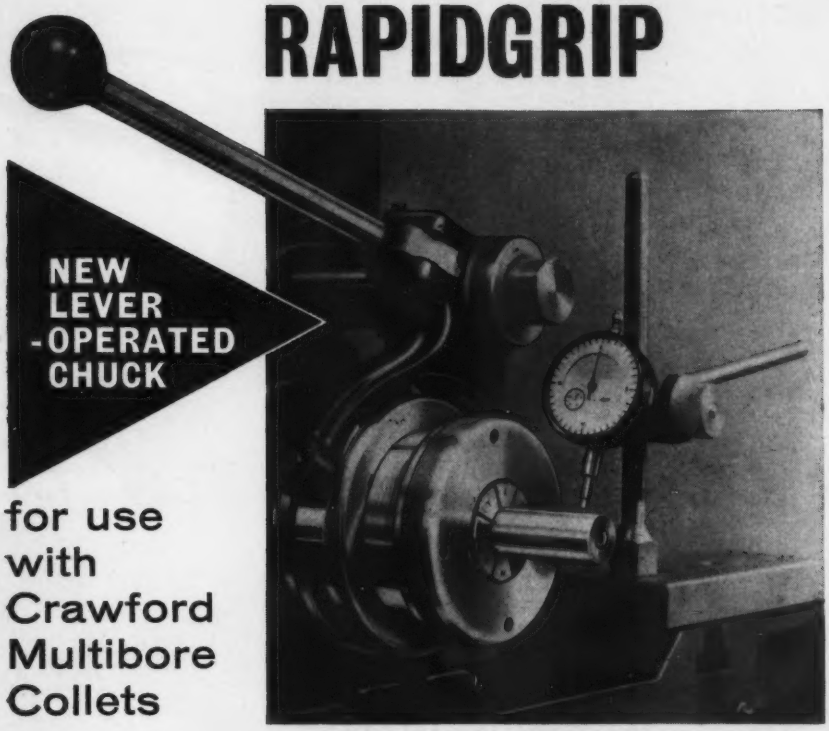

NEW LEVER -OPERATED CHUCK

for use with Crawford Multibore Collets

This powerful new dead-length chuck is particularly suitable for bar and second operation work; fitted with a Crawford rear support stop it can hold exceptionally short pieces. It is designed for operating the Crawford Multibore Collets with their i" size range. There's less operator fatigue, too, because Rapidgrip's simple, powerful rack and pinion gear is easier to operate than more direct lever systems of collet closing. Another special feature is the fixed front cap which ensures constant accuracy. An independent key allows easy bore adjustment.

CRAWFORD COLLETS LIMITED

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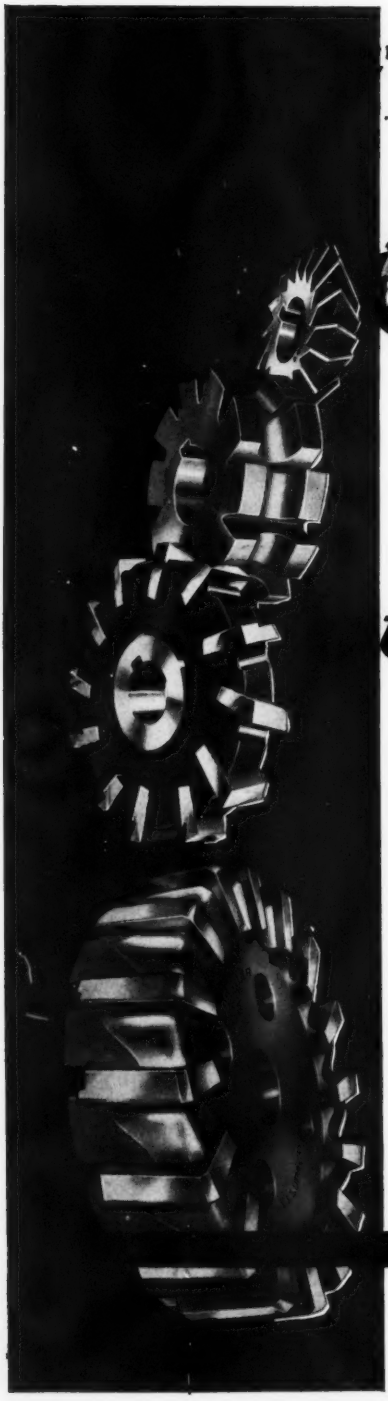

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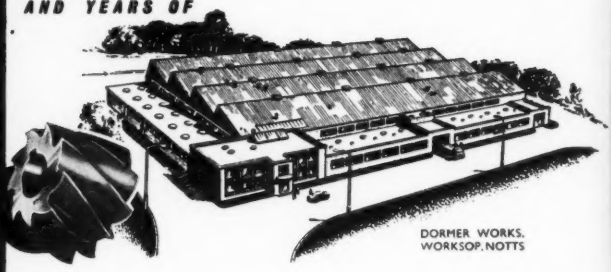

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SOLID AND INSERTED TOOTH CUTTERS IN A COMPREHENSIVE RANGE OF TYPES AND SIZES

Many are immediately available from stock
Send for Brochure and Stock List

SUMMERFIELD ST. SHEFFIELD 11
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DORMER CUTTERS ARE AVAILABLE THROUGH YOUR USUAL ENGINEER'S TOOL SUPPLIERS

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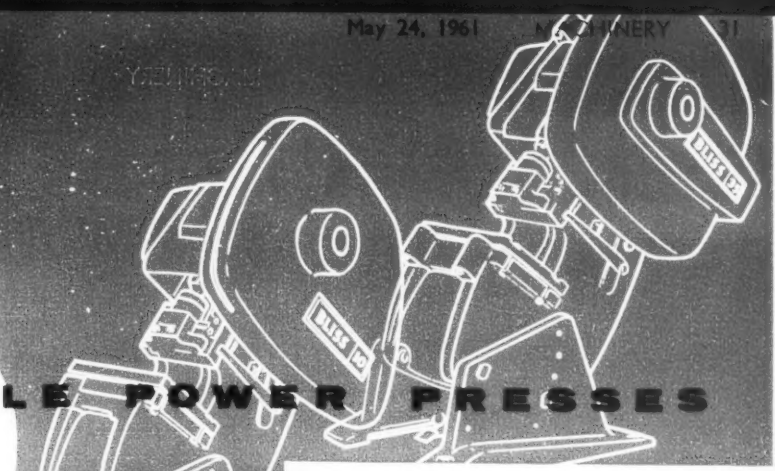
BLISS



INCLINABLE POWER PRESSES

With this range of Bliss Inclinable Power Presses, the operator has something new in visual design, technical refinement and ease of operation.

Many new features are embodied to give better performance, trouble-free operation and longer life, whilst maintaining the high standards of design and workmanship that have already characterised Bliss-built presses.

The range comprises twelve presses with capacities from 10 to 75 tons and illustrated literature is available, complete with specifications and dimensions.

- 10 FLYWHEEL
- 15 FLYWHEEL
- 25 FLYWHEEL GEARED
- 35 FLYWHEEL GEARED
- 45 FLYWHEEL GEARED
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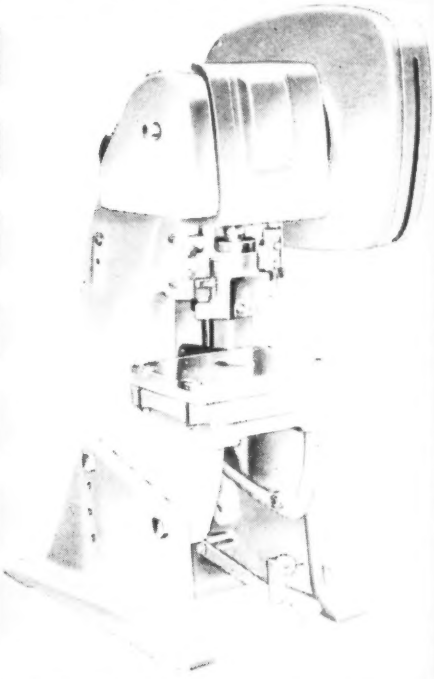

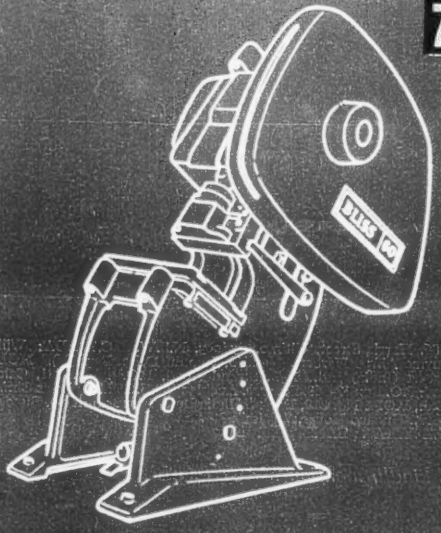

E. W. BLISS (ENGLAND) **LTD.**

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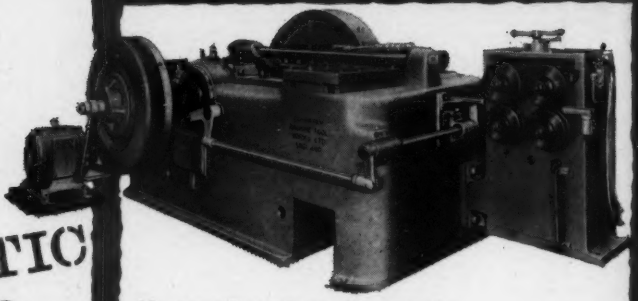
COVMAC

AUTOMATIC FORGER



No. 2 machine with guards removed.

The stock is placed between the rolls and is then fed through the dies to the workstop. The die then closes, cutting off the stock to the required length, and delivers it to the heading position. The heading tool then completes the forging, which falls down the chute and is taken away by conveyor.

The Automatic Forger can be supplied in several sizes and for making balls of up to and including 4in. diameter.

No. 3 machine illustrated.

These machines are made in three sizes. The smallest handles bars up to 2in. diameter. The largest size, as illustrated, takes bars up to 4in. diameter. They are an invaluable asset to any forging or drop stamping plant. We also make nine sizes of Standard Upsetting Machines to take bars from ¾in. to 6in. diameter.

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MACHINE TOOL WORKS LTD
GRANTHAM RD. HALIFAX ENGLAND
'Phone: Halifax 3234/5 'Grams: Covmac Halifax

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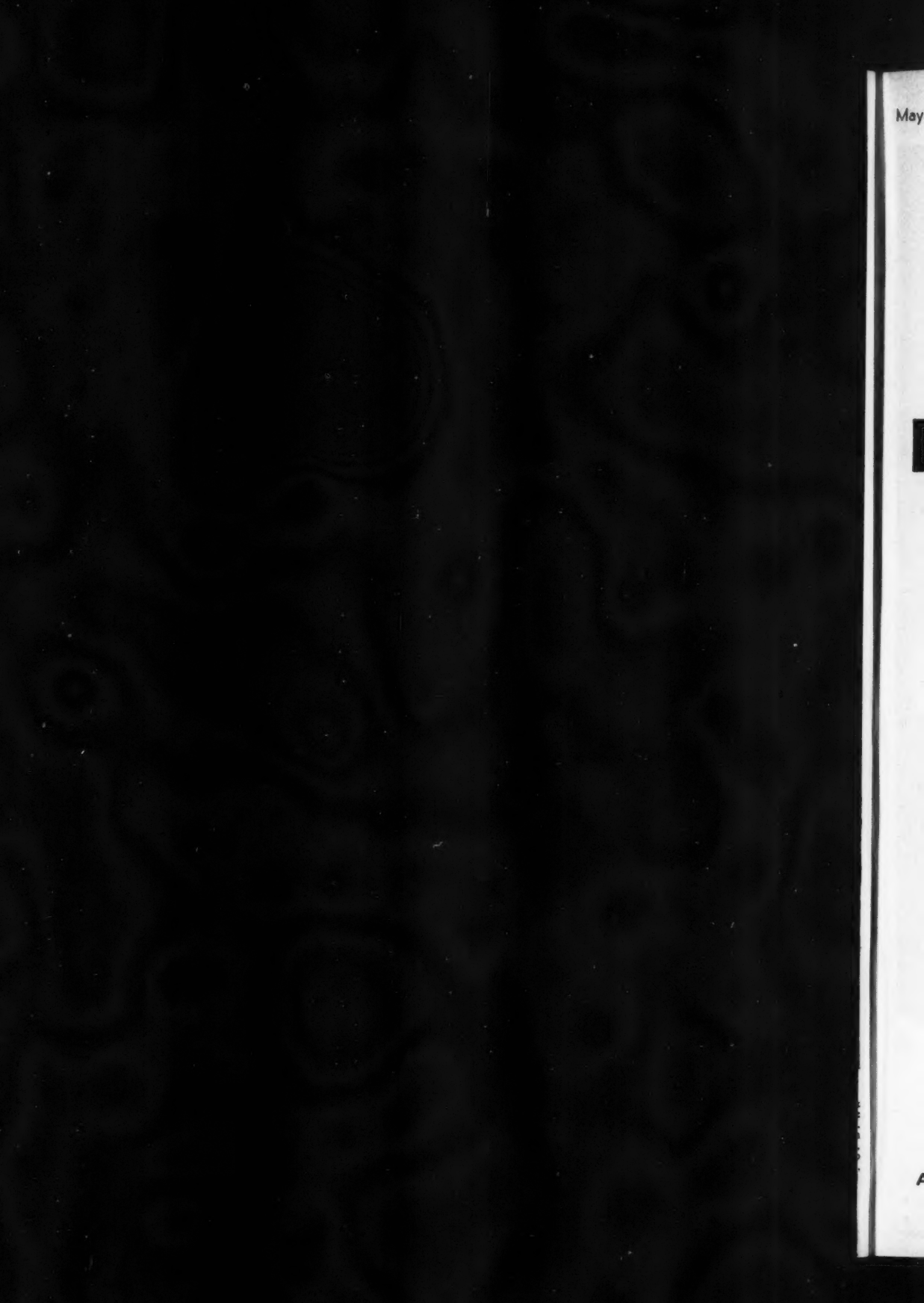
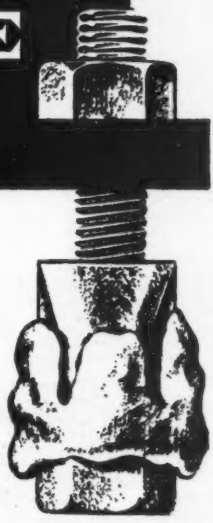


A SECURE ANCHORAGE



Where a heavy article must be positioned *before* it is bolted to concrete, brickwork or masonry — use Expandabolts. If the machinery or equipment can be placed over a bolt previously fixed — choose Anchor Bolts.
Both these simple fixing devices provide a secure anchorage which remains firm under the most violent movement.

HERE'S HOW THEY WORK:

EXPANDABOLTS

A hole is made and the complete bolt (set screw, saw-toothed split-sleeve and cone wedge) is placed in it. The set screw is removed and the article placed in position. The set screw is reinserted and tightened. This draws the wedge into the split-sleeve, forcing the saw-teeth to grip the concrete.

ANCHOR BOLTS

A hole is made, the bolt is inserted and the wedge is driven into the lead spreader, thus locking the bolt in position. The article to be fixed is then placed over the protruding bolt, and the nut is tightened.

philplug

EXPANDABOLTS AND ANCHOR BOLTS

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Table working surface: 50" x 10½".
Spindle centre to table: min. 3¾", max. 14¼". Write for illustrated leaflet A.207.

fully automatic table cycle
Spindle speeds from 25 to 880 r.p.m.
30 rates of feed — ½" to 20" per min.

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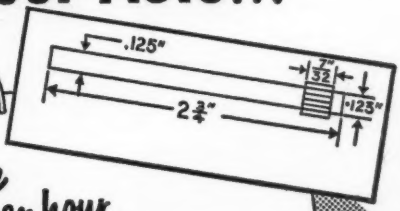

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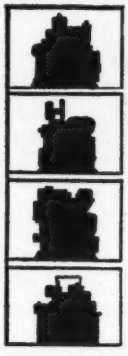

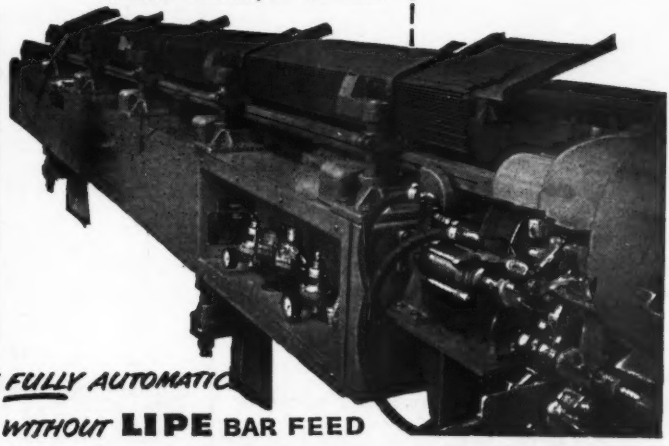

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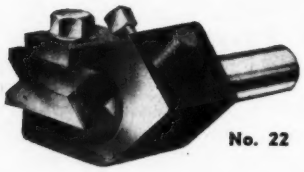
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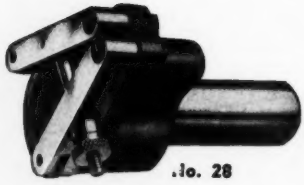
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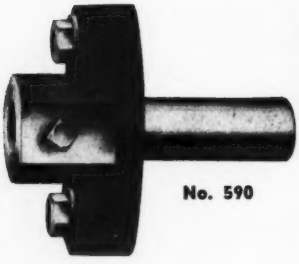
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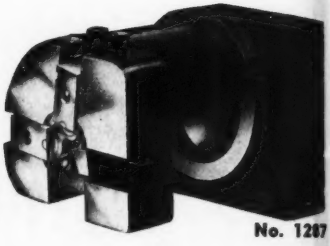
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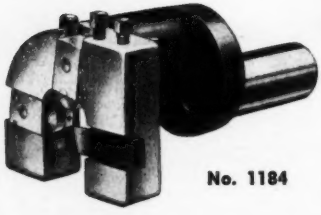
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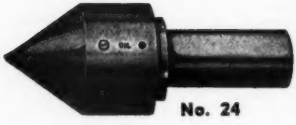
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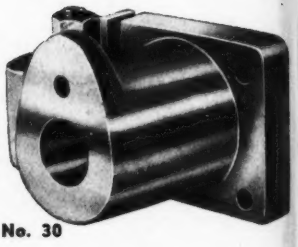
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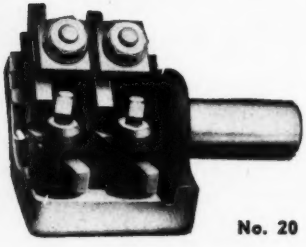
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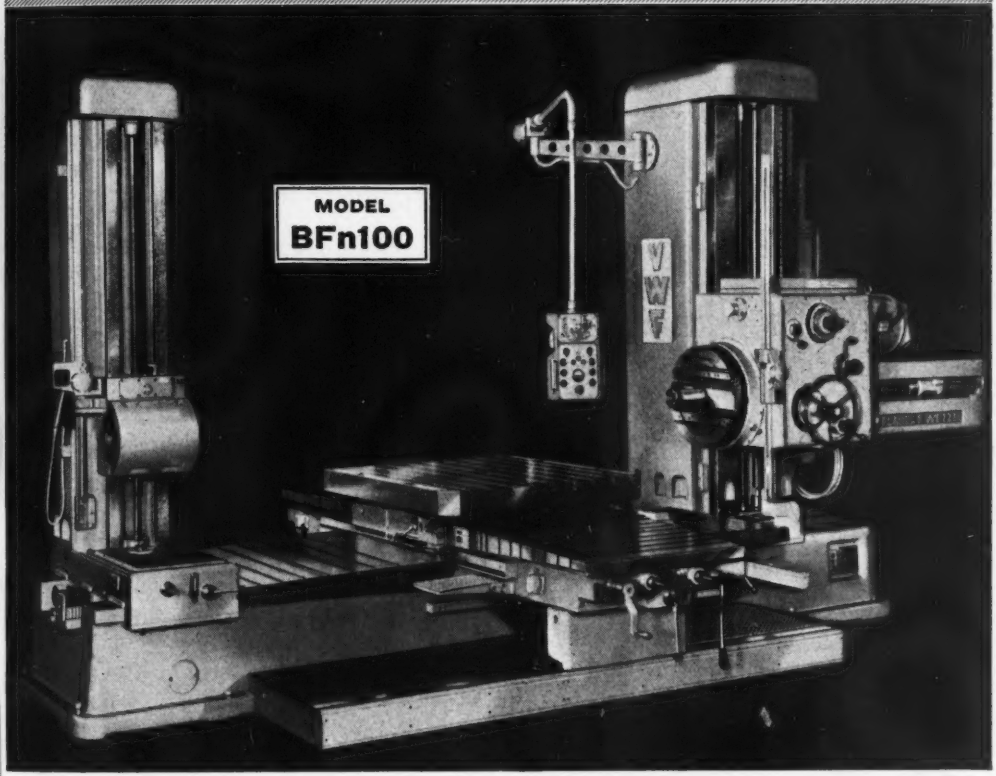

- Boring and milling spindles can be engaged individually or together, at identical or different speeds.
- Pre-selection of a wide range of spindle speeds and feeds, controlled from pendant station.
- Precision scales for co-ordinate settings, Optical fine setting equipment available as an extra.
- Rapid tool clamping in boring spindle by steep angle taper and quick-acting locknut.
- Adjustable, hardened outboard supports for the table slide; included as standard equipment.
- Fully automatic, timed lubrication of slideways, feed mechanism and spindles.

Brief description Model BFn 100

Table dimensions	50 in. x 55 in.
Table load, max.	8 tons
Distance between faceplate and steady	124 in.
Height of work spindle above table	0-55 in.
Cross and longitudinal traverse of table	69 in.
Boring spindle diameter	3.94 in.
Milling spindle diameter	7.09 in.
Boring depth in one traverse/with resetting	35/49 in.
Maximum diameter bored	35 in.
Facing diameter, max.	44 in.
Spindle speeds	9-1400 r.p.m.
Rapid traverse (all directions)	138 in./min,
Main motor	20 HP.
Weight (net, with steady)	17 tons

other models are available

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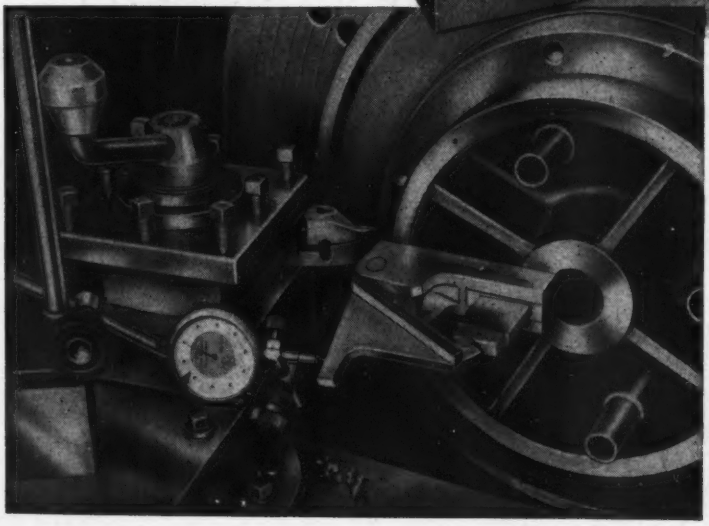
NM51

'HABIT' Magnetic Sine Bar

LEAVES BOTH HANDS FREE FOR ACCURATE SETTING!



Essential for the rapid angular setting of machine tables, slides, toolholders or work to extreme limits of accuracy without using makeshifts. Permanent magnets incorporated in the base provide a positive lock-on to the work-piece or machine so leaving both hands free for setting operations.

★ *Make it a* **'HABIT'** *to be accurate!*

The Habit Magnetic Sine Bar is manufactured from the finest hardened materials and is lapped on all gauging faces. Angular setting problems are solved with an accuracy not possible with Vernier scales and protractors.

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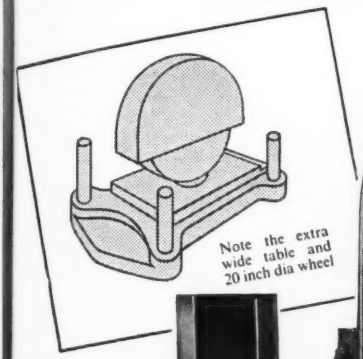

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- Grinding head swivels through 360°.
- Two spindle speeds.
- Available with pedal-operated hydraulic vertical adjustment for quick setting when grinding cutters of various diameters.
- Wide range of equipment available.

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Grinding diameter with raising blocks 16"
Grinding length 20"
Distance between centres (standard) 20"
Distance between centres (special) 30"
Spindle speeds 2650 & 5300 r.p.m.

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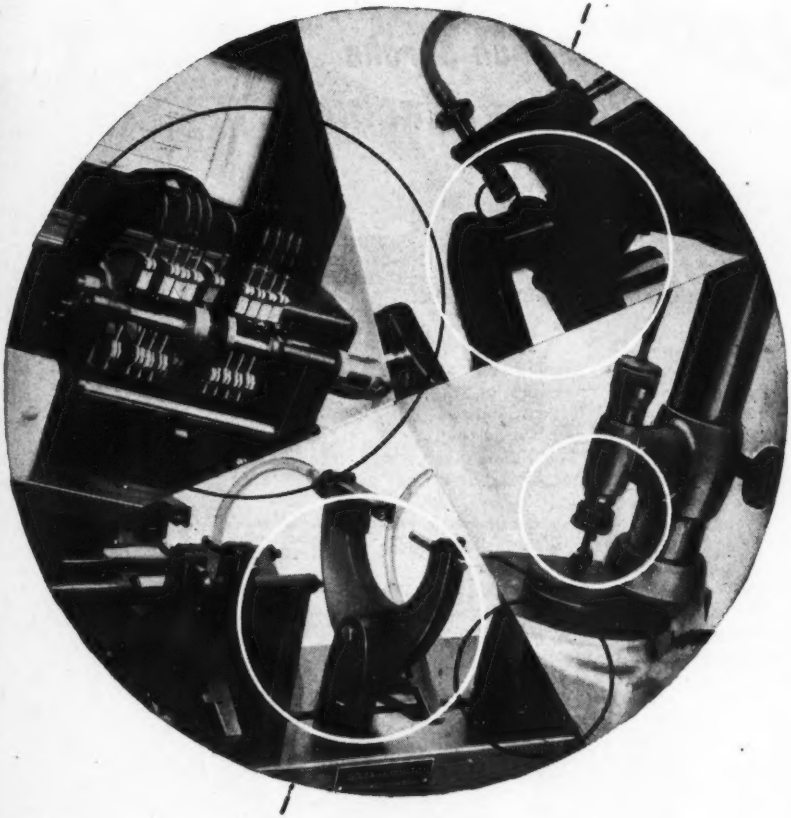

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A "great" little machine which in initial cost, production time and trouble-free service offers a 25% overall saving in manufacturing costs of any part within its considerable range of uses.

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This is a simplified version of the Mark 1 model, constructed from the same heavily designed main castings, but not incorporating the Rotary Table.

The two cross slides are hand fed only and the 7" x 6½" rectangular Tee Slotted Table is designed primarily to accommodate producting tooling.

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This model is fitted with a very serviceable 7in. diameter Rotary Table, which has been specially hardened, ground and graduated. Rapid, precise setting to within 1/1000th of an inch is provided by the accurately ground centre bore and tenon slots.

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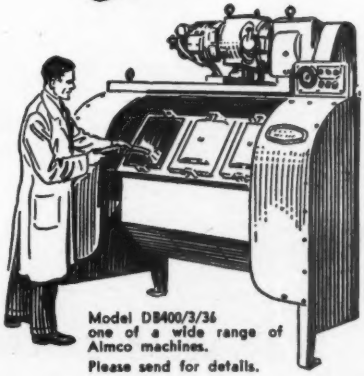

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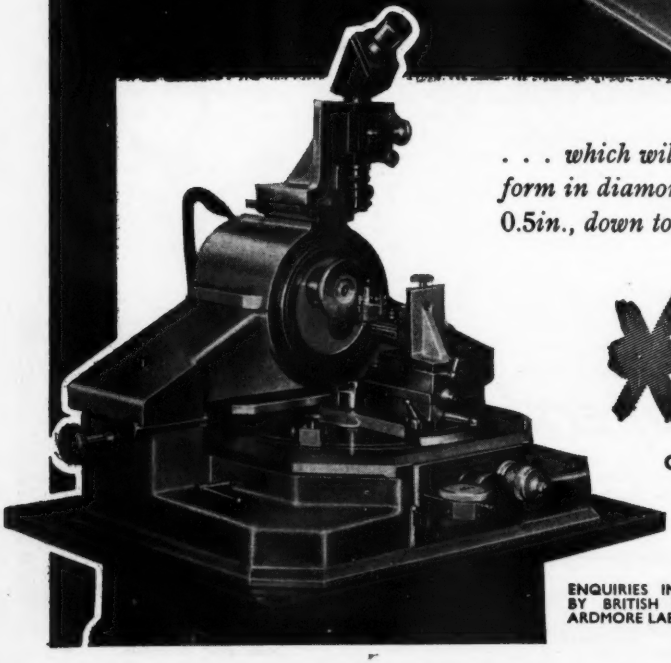

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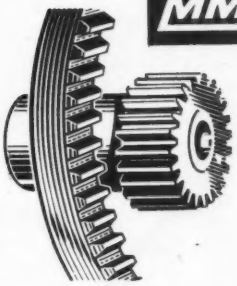

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REDIN GEAR DEBURRING MACHINES

MODEL 20

MODEL 36

MODEL 20		MODEL 36	
Capacity (External)		Capacity (External)	
Maximum Pitch Diameter	20"	Maximum Pitch Diameter	36"
Maximum Gear Face ...	6"	Maximum Gear Face ...	12"

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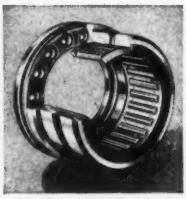
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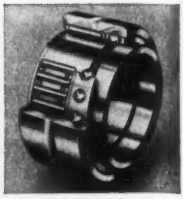
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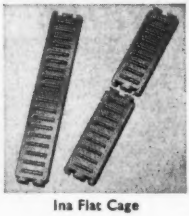
Ina Thrust Bearing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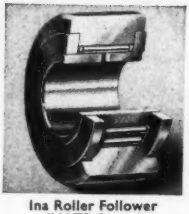
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- **High peripheral speeds.**
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Multi-spindle Drilling Machines
with adjustable spindle centres

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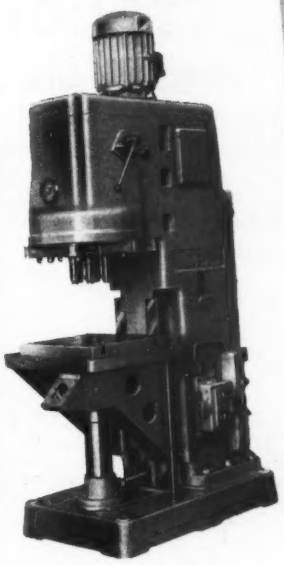
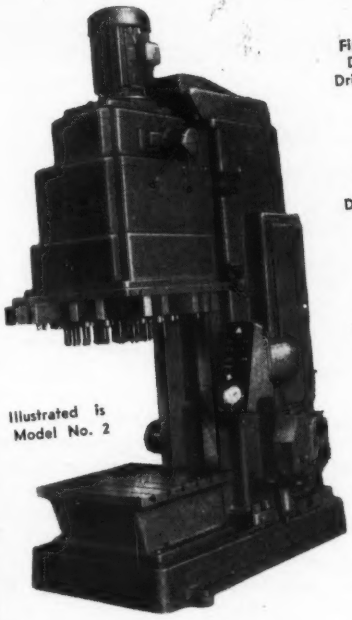
The illustration below shows Model No. 0





Illustrated is Model No. 2

RANGE OF MACHINES

No 0
Fixed head, moving table
Drive motor 5 or 7½ h.p.
Drilling area 10in. diameter, 10in. square or 13½in. x 8½in.

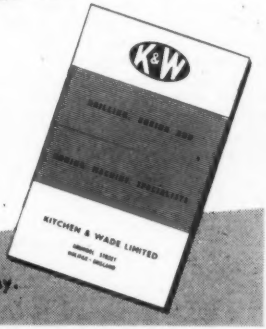
No. 1
Moving head, fixed table
Drive motor 10 h.p.
Drilling area 12in. diameter, 12in. square or 16in. x 10in.

No. 2
Moving head, fixed table
Drive motor 15 h.p.
Drilling area 18in. diameter, 18in. square or 24in. x 15in.

No. 3
Moving head, fixed table
Drive motor 20 h.p.
Drilling area 24in. diameter, 24in. square or 30in. x 18in.

No. 4
Moving head, fixed table
Drive motor 25 to 30 h.p.
Drilling area 30 in. diameter, 30in. square or 36in. x 24in.

This 60 page catalogue illustrates and describes the range of K. & W. machines for the modern machine shop.



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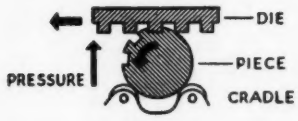
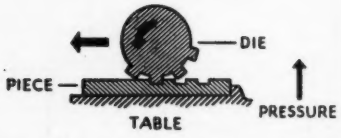


Each round part is located in a cradle and is raised under pressure against a flat die carried in the head. The die then traverses and the impression is made in the part smoothly and evenly.



Each flat part is located in a holding fixture and is raised under pressure against a round die carried in the head. As the die traverses, it rotates, making the impression in the part. In both cases a small portion of the die only is in contact with the piece and positive pressure ensures a consistently clean mark. Shock impact is practically eliminated.

. . . needs a Funditor Heavy Duty Marking Mc.

This semi-automatic hydraulic machine has been specially designed for deep marking tough materials without effort. Its rolling action and controlled heavy pressure results in impressions of consistent clarity. By use of the appropriate dies and fixtures deep marking or knurling can be performed with ease and high rates of production obtained by unskilled female operators.

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WITH **EMI** ELECTRONIC CONTROL

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Built for inspection or production functions, the table has a spacing accuracy within ± 3 secs. . . . . equal to that obtained with the most precise optical tables. The centre setting plug revolves to within 0.0001" of absolute concentricity—the platen rotates in one plane to within 0.0002".

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As a guide to production economy accomplished with the table, the following statistics would relate to drilling 100 holes in a plate on a 24" pitch circle diameter, all within 0.0002" spacing accuracy and assuming a drilling time of 5 seconds per hole.

Time for complete revolution of platen . . .	40 secs
Time for positioning and clamping (5 secs x 100)	8 mins 20 secs
Drilling time (5 secs x 100)	8 mins 20 secs
TOTAL PRODUCTION TIME	17 mins 20 secs

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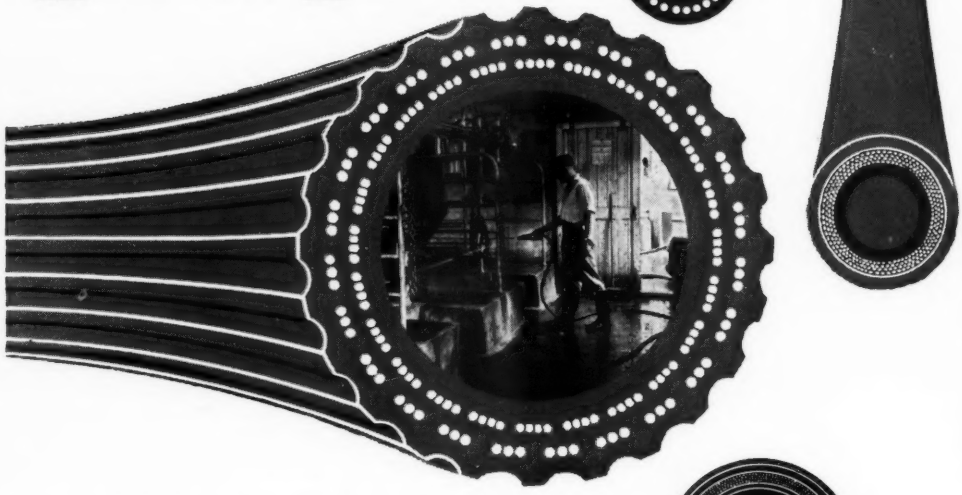

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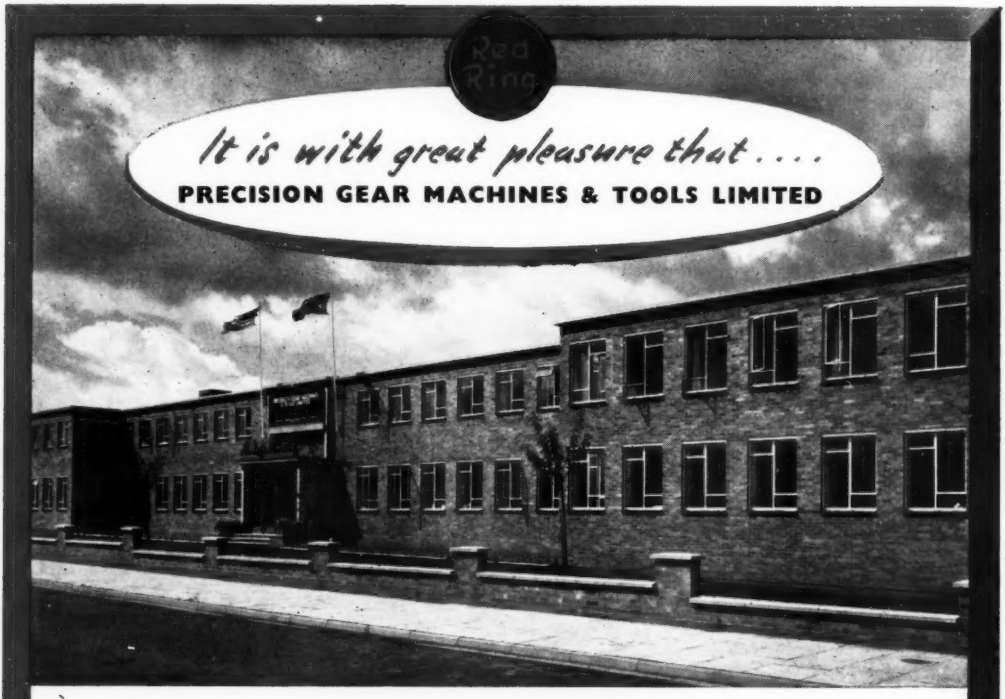

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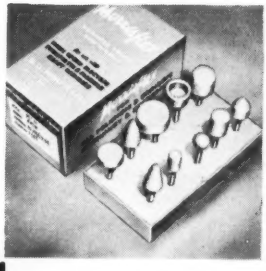

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Optical measuring system does not depend on lead screws, gauge blocks, bars or limit switches—is permanently protected against mechanical wear. Only a light beam touches helically scribed cylindrical measuring scales which are independent of table movement mechanism and are immovable in axial direction.

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AUTOPOSITIONER enables operator to preselect table position for next hole while one boring operation is in progress—eliminates non-productive time between holes. As one hole is completed, table moves in rapid traverse to the next pre-selected position. (Available only on Model LB15A).

Projection screen eliminates operator eye strain and bending—helical line from measuring scale is projected on 2½in. by ¾in. screen which operator reads in standing position without eyepiece.

Automatic table clamping prevents errors in clamping and unclamping table between movements.

Model LB15A with AUTOPOSITIONER
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(without AUTOPOSITIONER)

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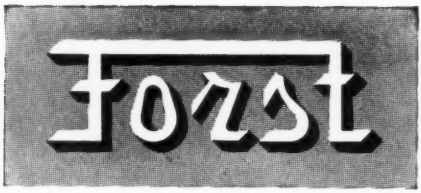

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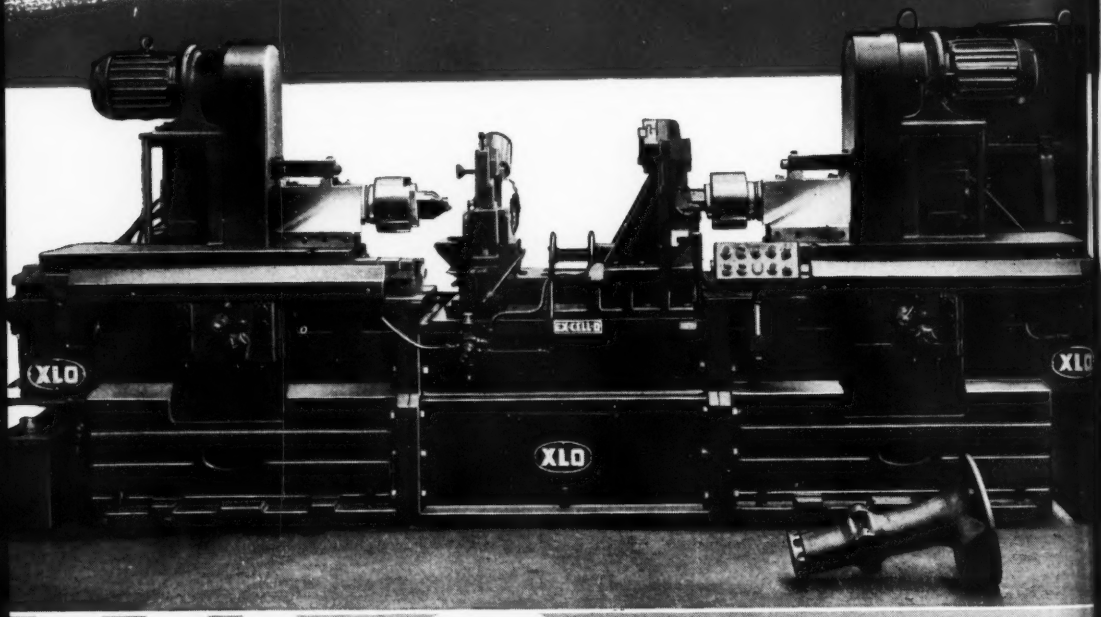
The fixture has hydraulic clamping with manual loading and unloading. Production at 80% efficiency is 28 axle housings per hour.

EX-CELL-O machines can be supplied ready tooled to meet any production requirements. Ask for estimate on your own work.



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Fully Automatic Copying Lathe — *for quick change over*

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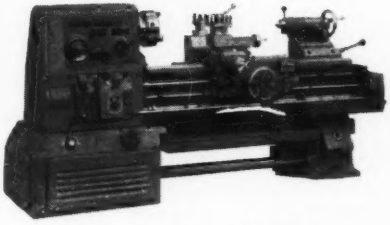
Tool room and Production Lathes with capacities up to 29in. swing over bed and 160in. between centres are available with or without copying equipment.



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Developed to make available fast, accurate copying methods and piloted feed features for small and medium quantity production. Special attention has therefore been paid to accessibility of setting mechanisms and speed of set up.

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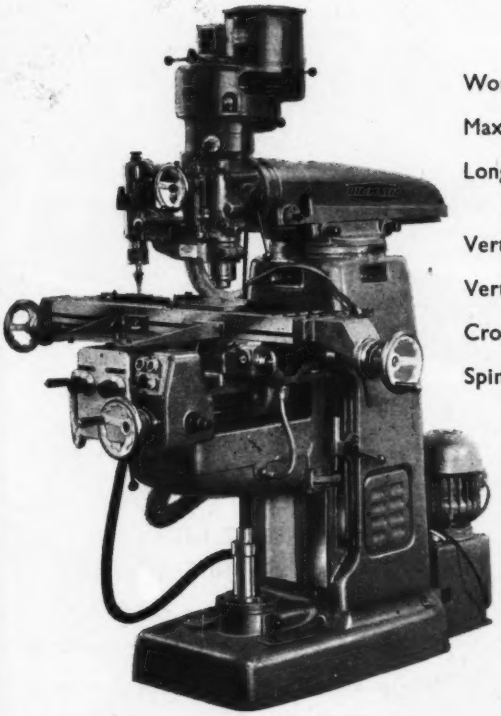

SPECIFICATION

Working surface	43" × 10"
Max. dist. spindle to table	14½"
Longitudinal table traverse ..... (hydraulic—manual)	14" + 14"
Vertical (knee) (hydr.—manual) ..	4" + 13"
Vertical (quill) (mechanical)	5"
Cross (saddle) (hydr.—manual)....	10" + 10"
Spindle speeds range, r.p.m.....	80 to 2715

PRICE £2,125 - 0 - 0

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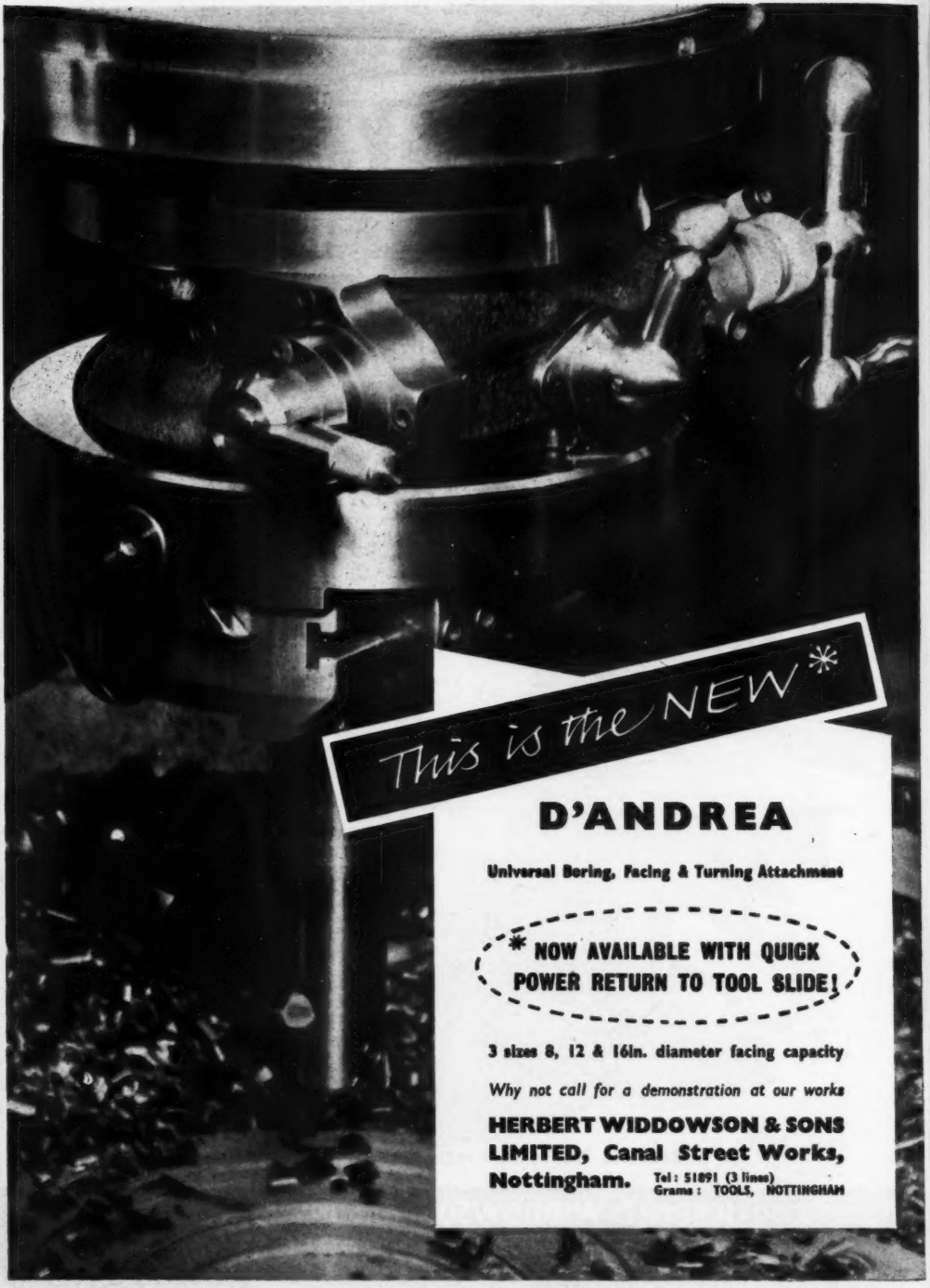
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All models complete with Standard Equipment including :

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- Vertical Milling Attachment
- Arbor
- Front Support Braces

Specification :

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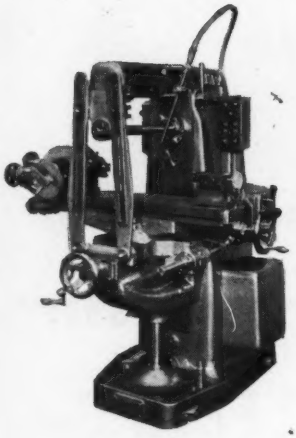
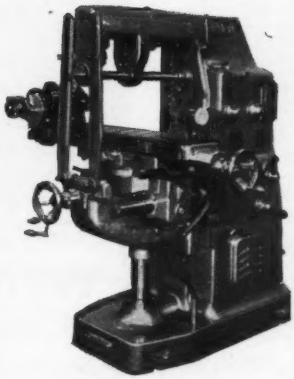
Table	34″ × 8¼″	39⅜″ × 9″	48″ × 11″
Long. Trav.	20″	26″	29″
12 Speeds	32-1000	60-1200	40-2000
Spindle Nose	No. 40	No. 40	No. 40
PRICE ★	£880	£1100	£1825

TEST UNIVERSAL MILLING MACHINES

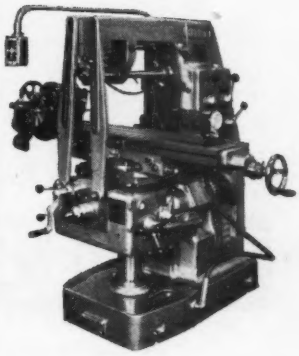
Model 0



Model 1



Model 2



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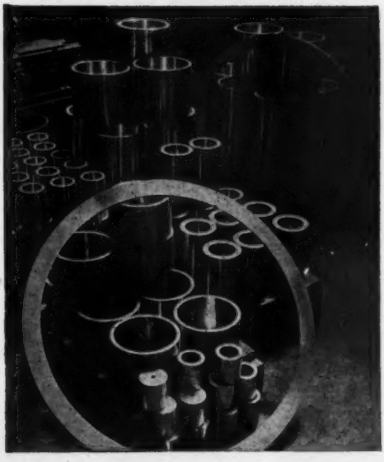

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Supplied as rough machined blanks or finished machined components—Also supplied Centrifugally Cast in Leaded Bronze, Manganese Bronze and Aluminium Bronze.

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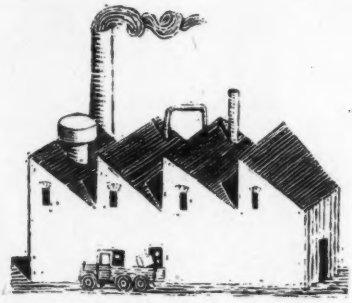

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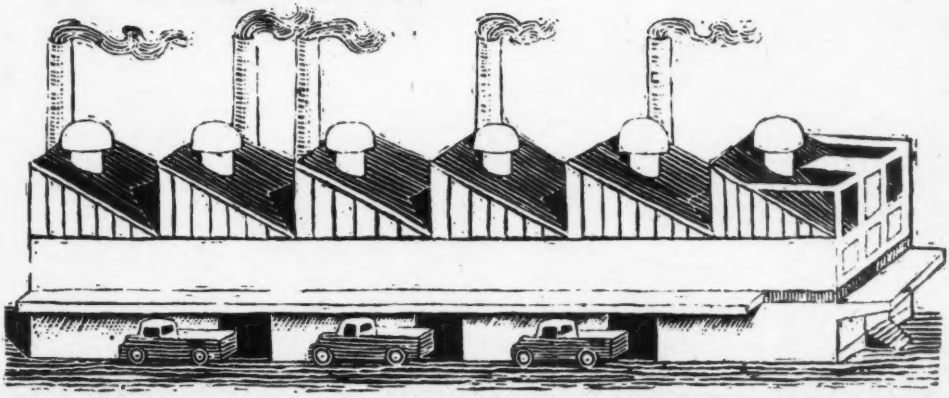

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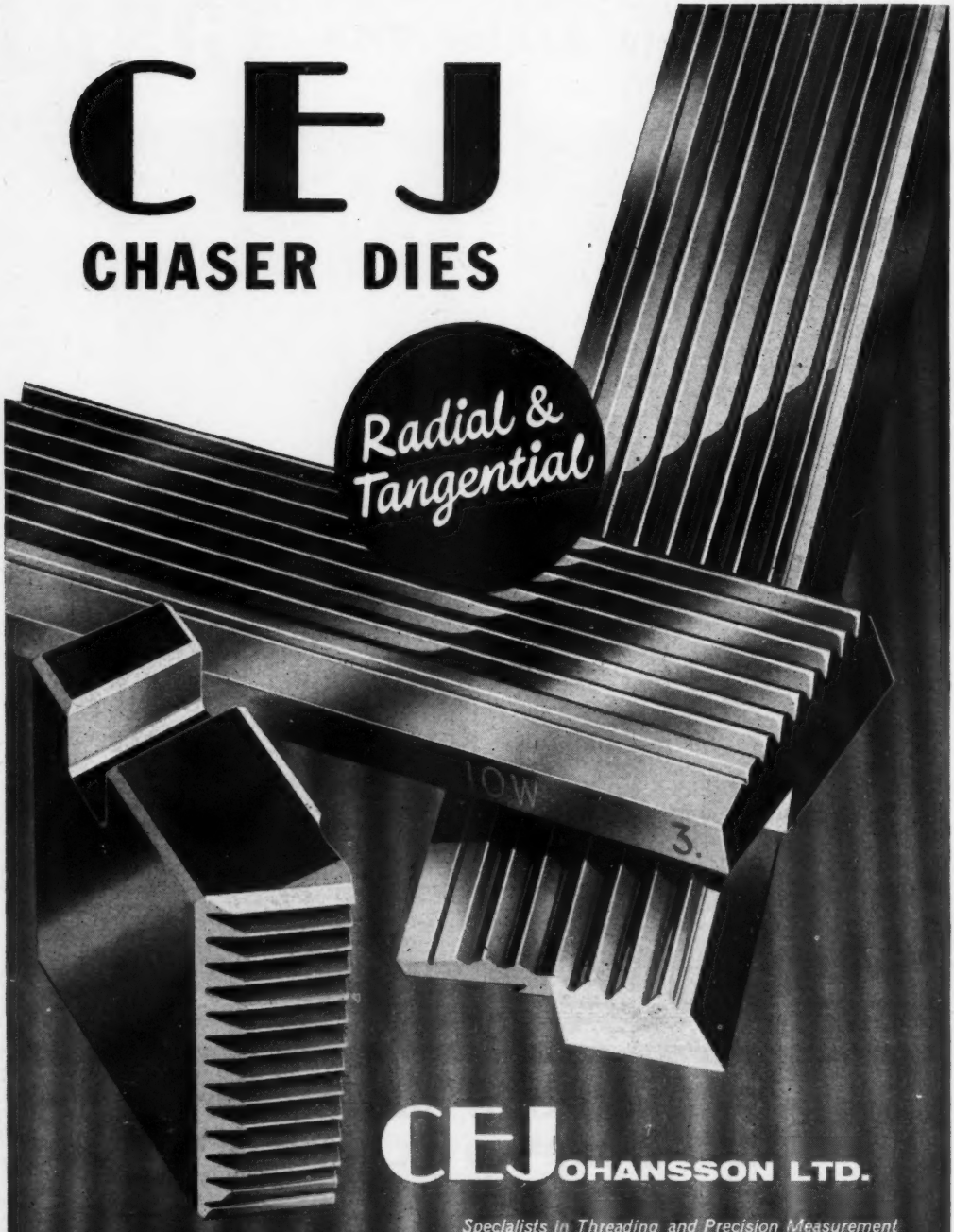

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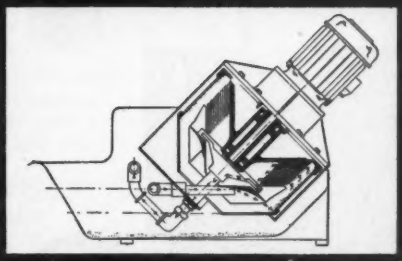

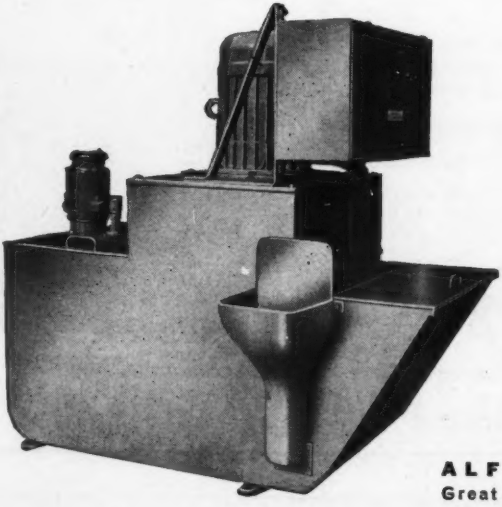

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Rated capacity 750 g.p.h. *(depending on application).*
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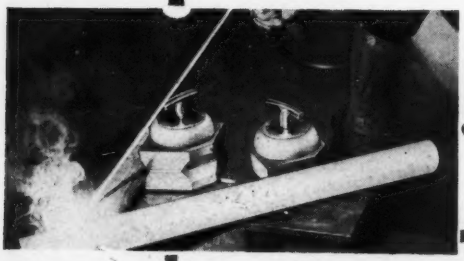
hold your welding work magnetically



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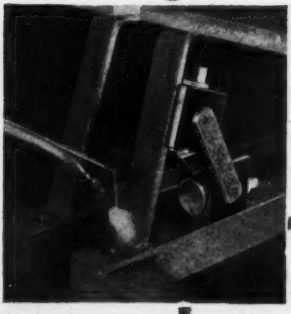
A large pot magnet unit offering the solution to many holding & positioning problems. Available in two sizes.



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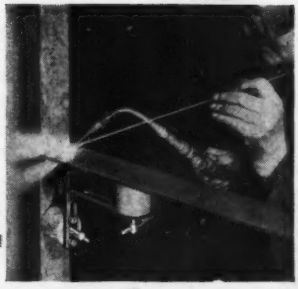
Exceedingly versatile & in fact provides an additional "pair of hands."



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Compact units in three sizes.
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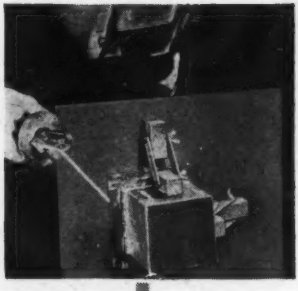

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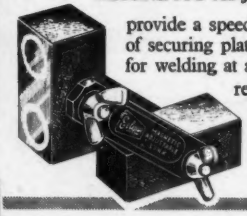

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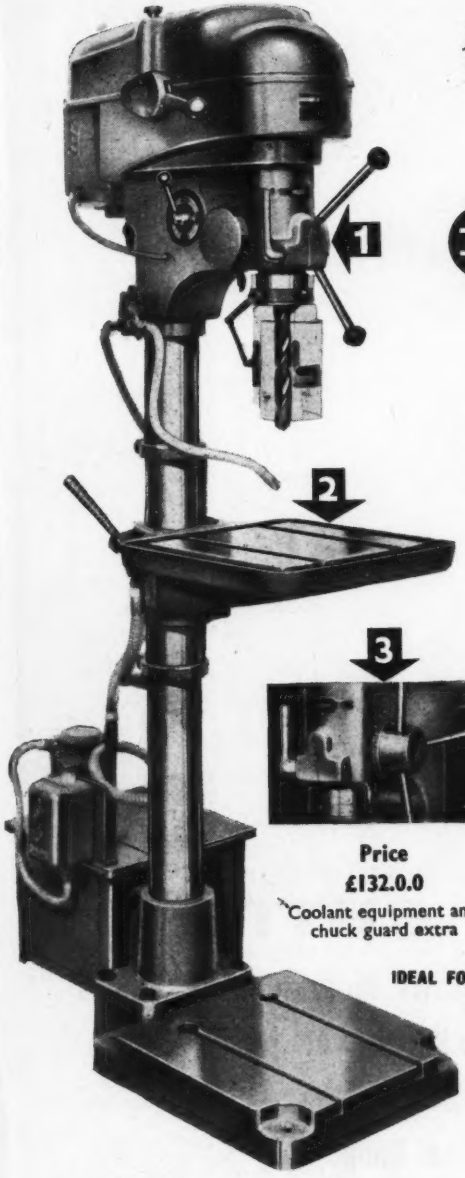

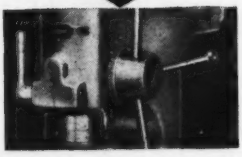

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3. Friction/clutch type Depth Stop—integral with star wheel—has graduated scale for accurate depth drilling.

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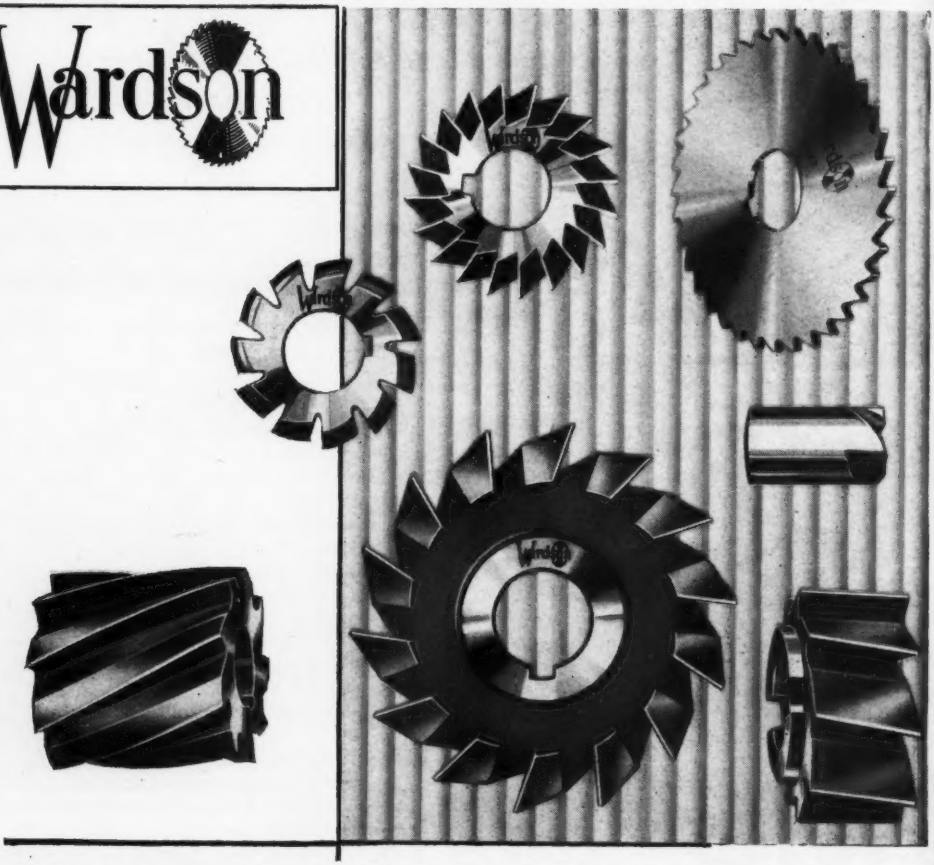

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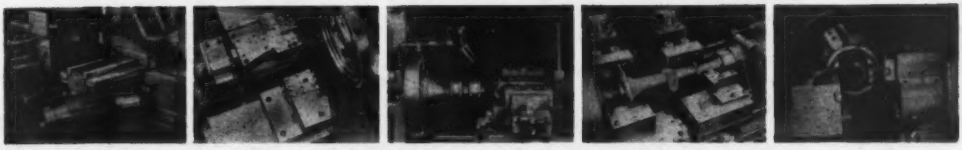

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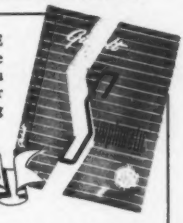

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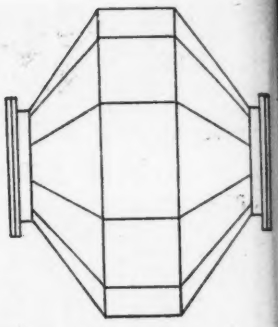

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- ★ **Introduced to meet the requirements of modern precision finishing, these new barrels will find widespread application.**
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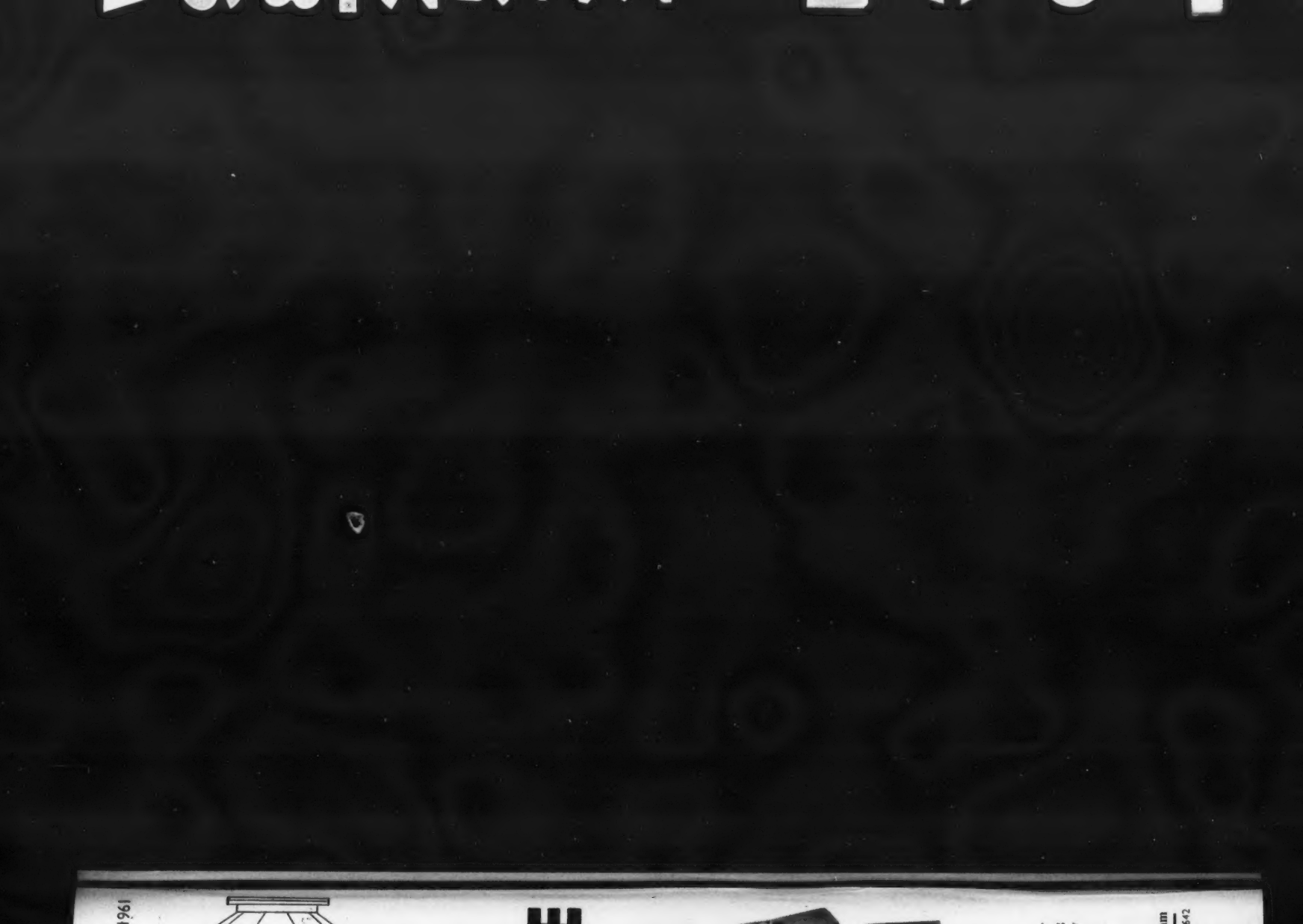

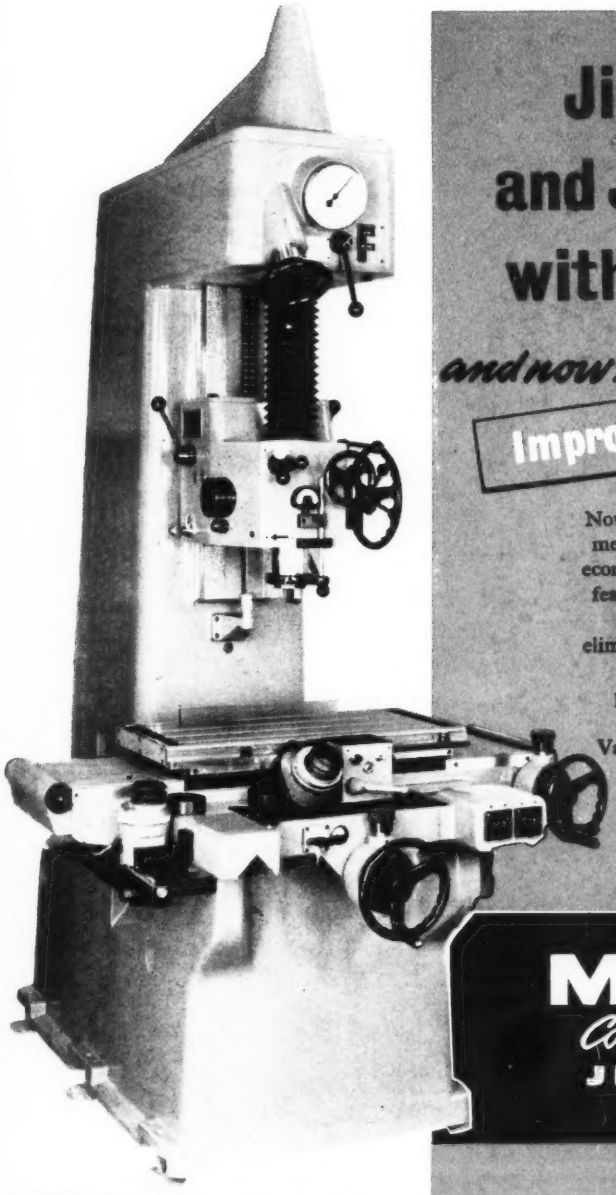

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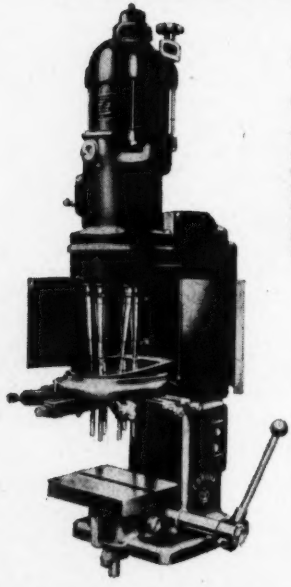

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UP TO 12 SPINDLES IN AN AREA OF 12in. — 8in.
MAXIMUM DRILLING CAPACITY ⅜in.

These machines keep costs low on multiple repetition drilling. Any number of spindles up to 12 can be employed and adjustment is rapid and simple. Feed is by lever and rack-operated table with a vertical adjustment of 20in. Available with electrical reverse.

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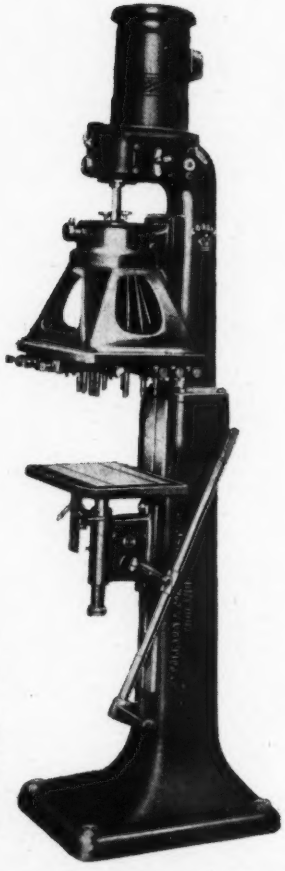

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On the right can be seen a typical arrangement of cutter blades on the table of a Snow Surface Grinding Machine.

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for continuous and accurate production

Fourteen of these vertical surface grinding machines are installed at the Tenbury Wells factory of Richard Lloyd Limited, and as shown in the close-up view on the right they are extensively used for rough grinding cutter blades for the well-known range of " Galtona " Serrated Blade Cutters.

The V type Snow machine is specially suitable for heavy duty requirements—hydraulic reciprocation of the table gives variable speeds up to 100 ft. per min. with shockless reverse and design features ensure maximum ease of control and minimum " down-time " for serving and maintenance.

Built in a range of sizes with table working surface 32in. by 10in. up to 180in. by 20in. and height, table to wheel, 12in. to 24in. Write today for a catalogue describing the Snow V type range.

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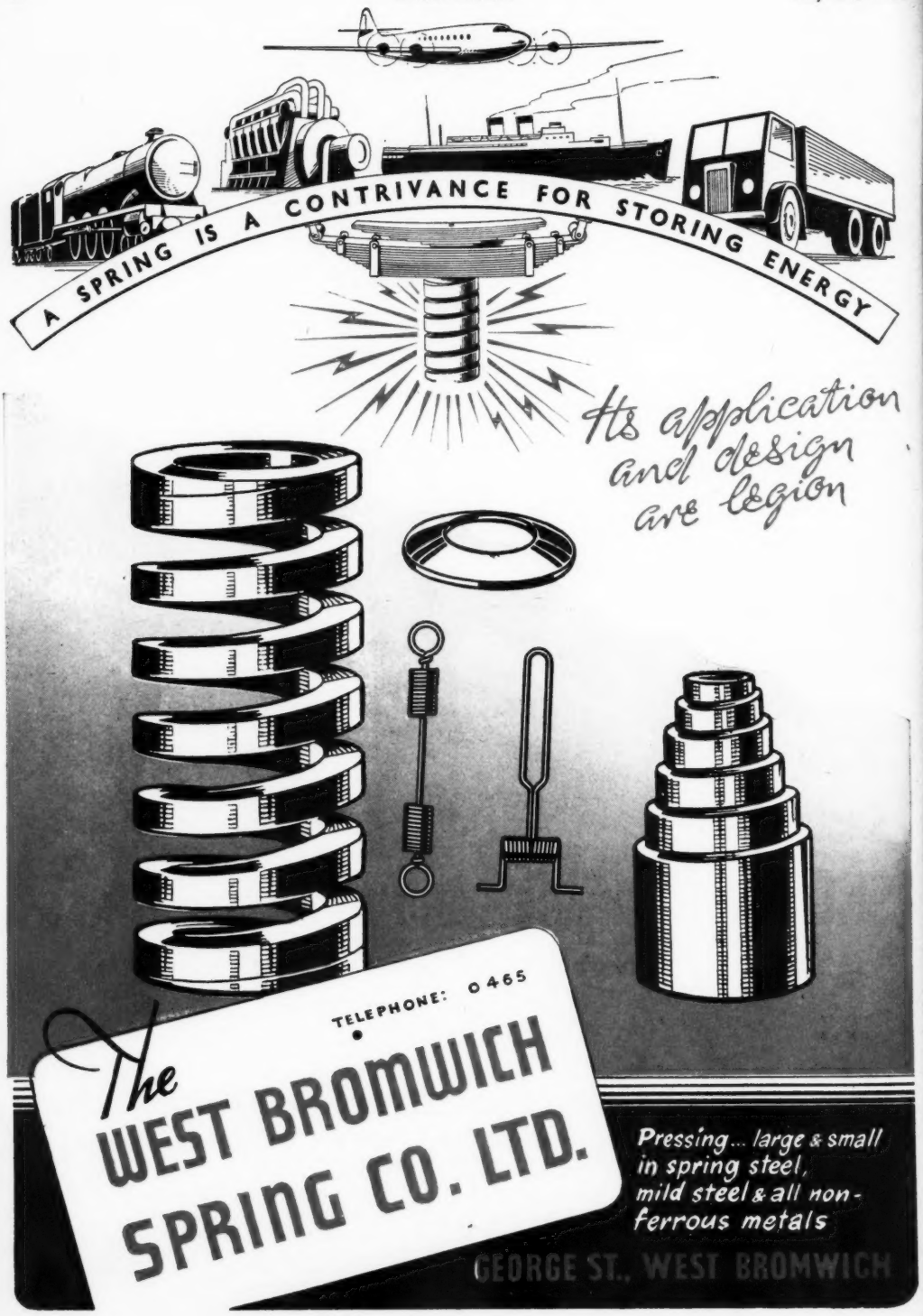
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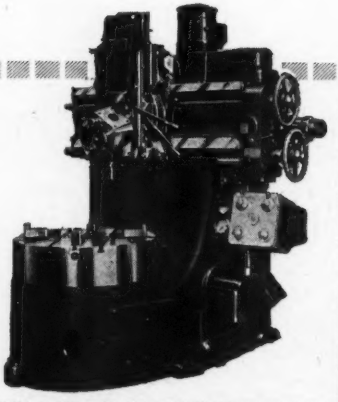

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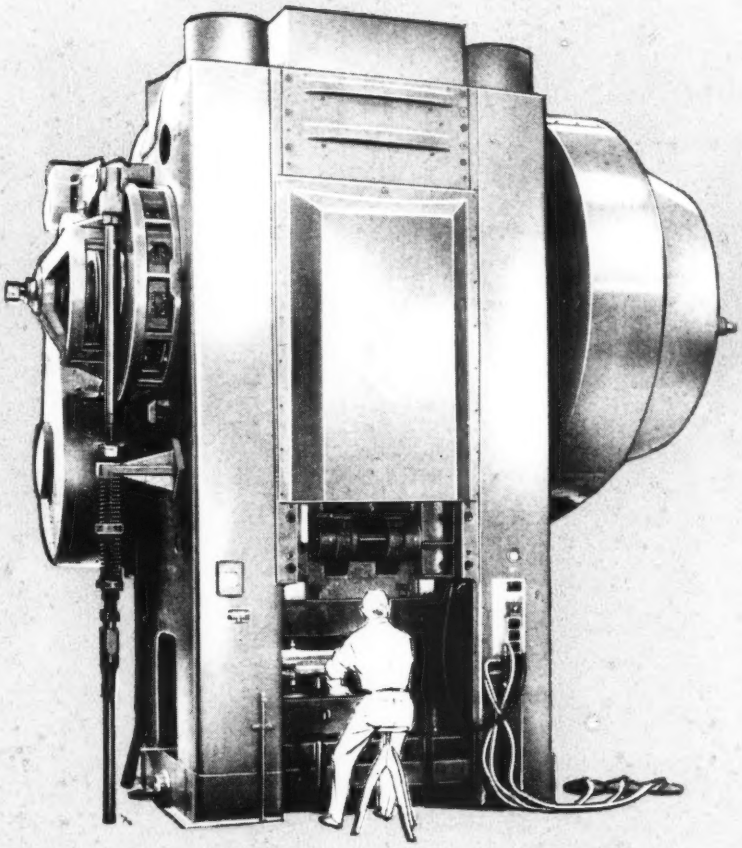

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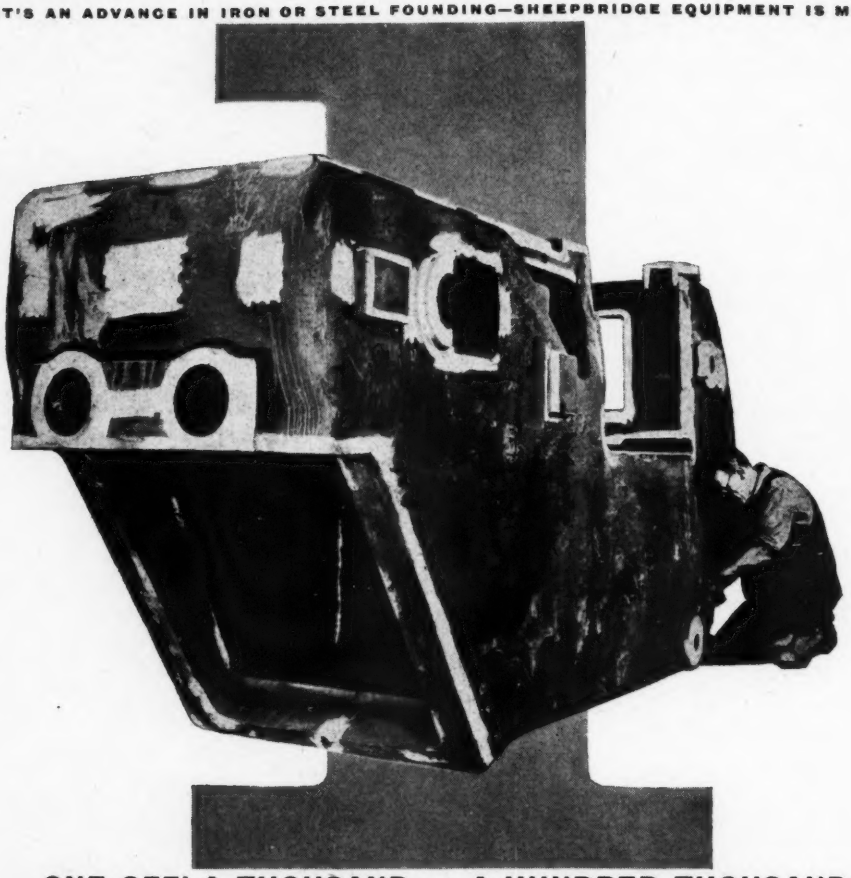

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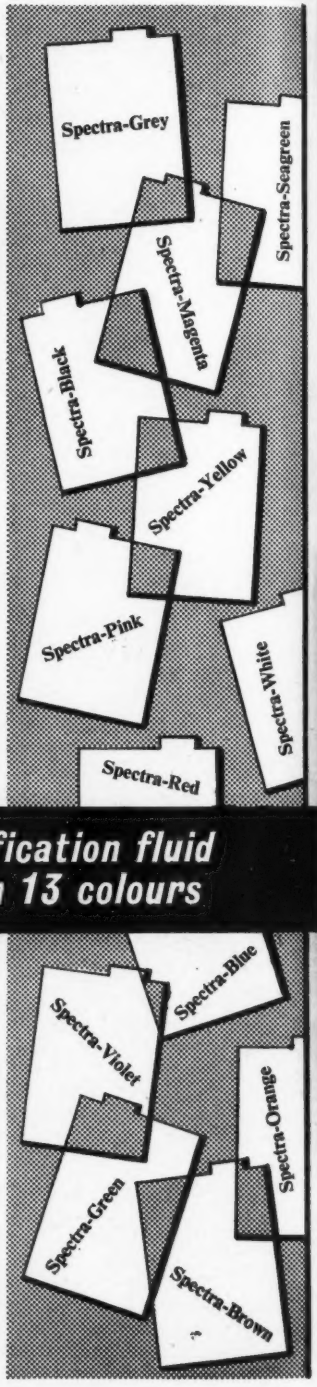

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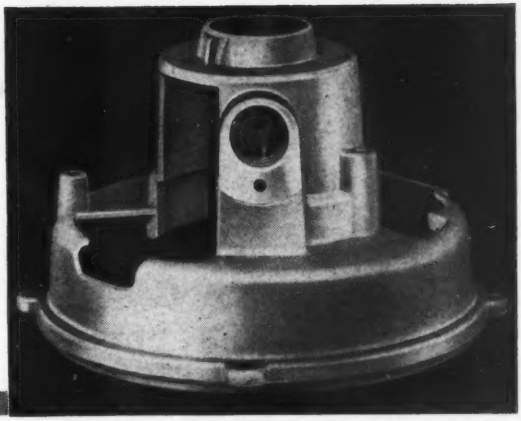
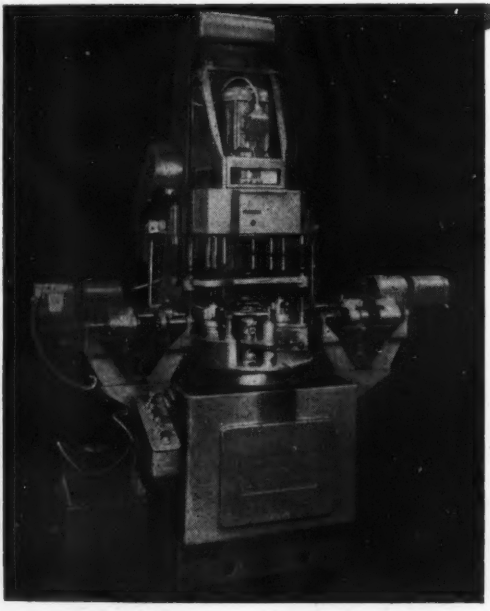


Working with the MULHEAD Mk IV ROTARY AUTOMATIC



By successfully solving such production . problems, this standard versatile high-speed machine raises output and reduces cost. It can probably do so for you.

Ask for a full specification.

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THE GENUINE IRON BASE FILLER

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"GLASTEC" iron, combined with glass fibre, can easily be fabricated into jigs, fixtures and forming discs. The process is simple and cheap and the finished product gives reasonably long life.

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AVAILABLE IN 6 lb. 12lb. & 24 lb. PACKS.
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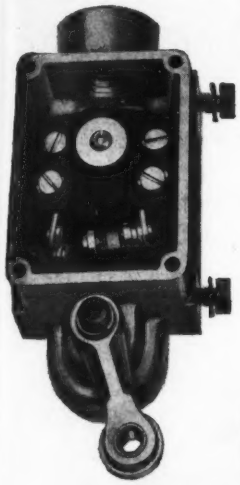

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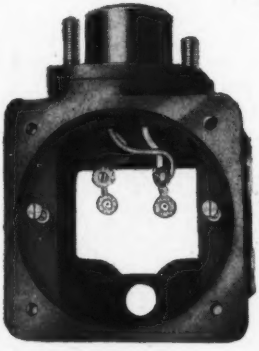
Single pole, double break, double throw, operates with either circuit normally open with other closed, or maintaining in either position, or available with central (neutral) position and/or centre connection. Heavy aluminium die-cast case. Conduit ¾" B.S., or No. 3 Admiralty Pattern Cable gland entry. Two-screw side mounting or backplate mounting in two styles, or Tandem style (back to back mounting). Operating lever position adjustable in 7.5 deg. increments through 82.5 deg. either way from normal.



The mechanism of the Flameproof switch is easily removable as a unit for servicing.

Standard Neutral position or Centre connection

MARK II

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SINGLE OR DOUBLE ENTRY

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B.S.A. SNAP-LOCK ACME

Catalogue of switches and levers on request

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Made in England under Licence by
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A few examples from the range of more than 40 styles (over 150 sizes) of interchangeable operating levers. List on request.

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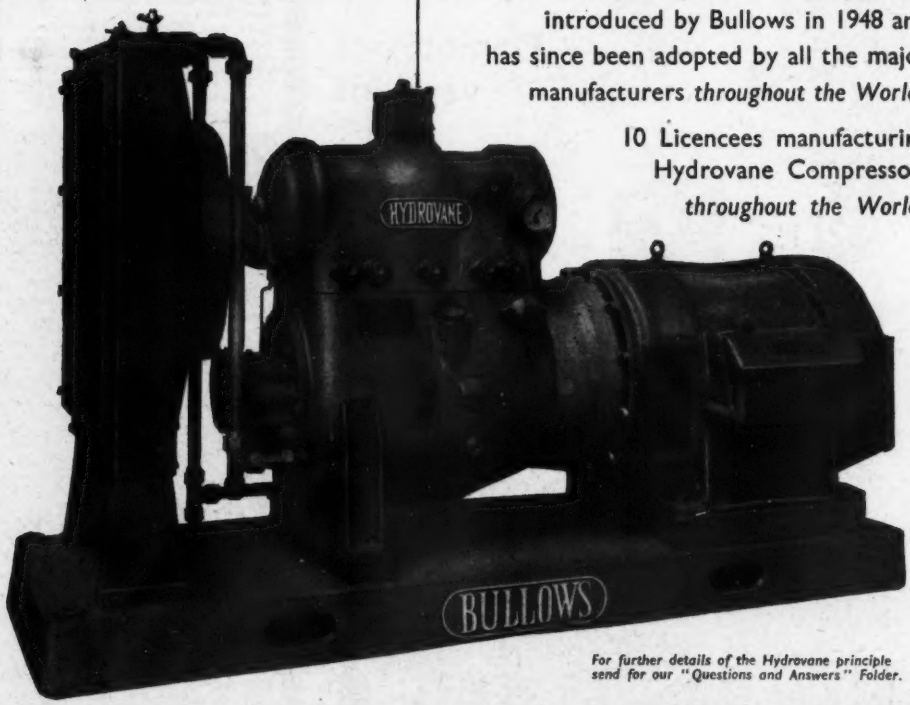
10 Licencees manufacturing Hydrovane Compressors *throughout the World!*



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MACHINERY

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CONTENTS

Editorial PAGE

The Machine Tool Situation 1163

Principal Articles (*For abstracts see next page*)

The Quantity Production of Poppet Valves 1164
Making Components for Marine Diesel Engines 1175
The Sprayflow Stellite Hardfacing Process 1180
Adaptation of a Centreless Grinder for Formed Work .. 1182
Quantity Production of Stainless Steel Bodies for Coffee Percolators 1185
Balata Belting 1189
Russian Machine Tools at the Leipzig Fair 1191
Sidney G. Jones Demonstration 1199
National Physical Laboratory Open Days 1201
Monks & Crane Machine Tool Exhibition 1204

Short Articles

Constant Pressure Arrangement for a Magazine Feed .. 1174
Adcock & Shipley Installation for Milling Radio-active Materials 1179
Arrangement for Remote Pre-setting and Control of Linear Motion 1183
New Contact-less Switch 1184
Magnetic Sheet "Floaters" 1188
Young Hydraulic Gear Pumps 1188
M.T.E. Contactors with Time Delay 1190

News of the Industry

Yorkshire 1207
The Midlands 1209
Machine Tool Exports and Imports 1211
Industrial Notes 1212
Scrap Metals Report 1214
Machine Tool Share Market 1215
Prices of Materials 1216

Classified Advertisements 141
Index to Advertisers 173

Abstracts of Principal Articles

The Quantity Production of Poppet Valves .. .. P. 1164

In this second article on the manufacture of poppet valves for the range of passenger cars and commercial vehicles made by Vauxhall Motors, Ltd., Luton, roll-straightening of the stems of the heat-treated and tempered valves is first considered. Straightening is performed on a flat-die thread-rolling machine, fitted with plain dies, at the rate of 52 per min. A special machine is then employed to cut off the valve stems to approximate length and to grind the end faces. A conveyor transfers the valves to the fully-automatic centreless machine on which the stems are next semi-finish ground, and they are then loaded into magazines on a multi-spindle automatic for turning operations on the head. Another special machine is employed for plunge-turning the collet grooves at the rate of 12 per min. (MACHINERY, 98—24/5/61.)

Making Components for Marine Diesel Engines .. .. P. 1175

At the Queens Island works of Harland & Wolff, Ltd., Belfast, a Craven sliding, surfacing, and boring lathe is employed for combined copy-turning and boring operations on cylinder liners, and details are given of the set-up. Copy-turning is also employed for weld-fabricated impellers for centrifugal compressors, and a set-up on a Berthiez vertical turning and boring mill is described. In addition, reference is made to the use of a twin-spindle Bryant grinding machine for operations on components for diesel fuel injectors, and to a special twin-spindle deep-hole boring machine which was built by the company. (MACHINERY, 98—24/5/61.)

The Sprayflow Stellite Hardfacing Process P. 1180

A new process for hardfacing has been developed by Deloro Stellite, Ltd., which provides for applying Stellite grades SF1, SF6, and SF12 in rod form and with the aid of the Mark 33 pistol made by Metallisation, Ltd. The process is known as Sprayflow and the applied deposits are alloyed to the base material by heat-treatment, after application. Three stages are involved, namely, preparation, spraying, and fusing, and the method is suitable for the deposition of thicknesses in the range 0·010 to 0·060 in. Full details are given of the procedure, and of its application. (MACHINERY, 98—24/5/61.)

Quantity Production of Stainless-steel Bodies for Coffee Percolators .. P. 1185

Methods are here described for producing bodies for automatic electric coffee percolators in large quantities at one of the works of Landers, Frary & Clark, New Britain, Conn., U.S.A. A considerable amount of new equipment was installed for this work, partly because the design required the production of components of different shapes from earlier versions, and partly because stainless steel is more difficult to draw and shape than the copper which was employed hitherto. For the body, the total depth of draw is 9¼ in., and the diameter at the bottom is 4⅜ in. Details are given of successive operations on a Cincinnati Hydroform press and of the conveyor-type furnace installed for bright-annealing between stages. Prior to spinning a bead at the top of the body, local induction annealing is carried out. Polishing of the exterior of the body is performed on Divine machines, with emery and grease and rag wheels, and a Bliss press with three sets of tools is used to punch various holes, for the spout and handle. The spout is brazed in position, and studs for securing the thermostat and lower part of the handle are resistance welded in place. Finally, the interior of the body is scratch-brushed with aluminium-oxide grit to provide the required satin finish. (MACHINERY, 98—24/5/61.)

Russian Machine Tools at the Leipzig Fair P. 1191

One of the most impressive displays of machine tools at this year's Leipzig Spring Fair was that staged by the U.S.S.R. in the ornate permanent pavilion, which included 18 standard machines, also two in-line transfer machines. This article, which is the first of a series, describes several of the standard machine tools, including a hydraulic copying lathe with a control panel which enables movements of the tool-slide to be programmed by turning selector switches, only the final pass being taken under copying control. A variation of the standard Russian centre lathe was also shown, equipped with automatic loading and unloading, and cycle-control equipment. A six-spindle automatic for bars up to 0·98 in. diameter has quadrant-linkage mechanisms to avoid the need for special cams. An automatic relieving lathe is designed for form relieving hobs and milling cutters, and can be fitted with a relief-grinding attachment. A vertical boring mill, and a vertical-spindle, auto. matic-cycle, surface grinder, are also described. (MACHINERY, 98—24/5/61.)

Contributions to MACHINERY

If you know of a more efficient way of designing a tool, gauge, fixture, or mechanism, machining or forming a metal component, heat treating, plating or enamelling, handling parts or material, building up an assembly, utilizing supplies, or laying out or organizing a department or a factory, send it to the Editor. Short comments upon published articles and letters on subjects concerning the metal-working industries are particularly welcome. Payment will be made for exclusive contributions.

EDITORIAL

The Machine Tool Situation

Throughout 1960 machine tool building firms in this country were generally busy and the pressure of demand tended to increase as the year advanced. In the circumstances, output of most companies was limited not by any lack of orders but by such factors as the scarcity of skilled labour in many areas and—particularly during the earlier months—by the difficulties normally associated with attempts to raise production rapidly after a period of recession. For the first half of the year, the value of deliveries averaged £7,500,000 per month, whereas in the second half the figure rose to £8,322,000. This growth in output was not quite sufficient to raise the average for the full year (at current prices) to the level achieved in 1957, when deliveries amounted to £7,936,000 per month. The results, however, represented a marked and welcome improvement in comparison with the averages for the years 1958 (£6,993,000) and 1959 (£6,564,000).

It will be noted that during the second half of last year production reached a rate of very nearly £100,000,000 per annum, and during the first two months of this year, for which figures have recently been issued, there was a further rise in the average of £9,155,000. This latter figure, it may be pointed out, corresponds to the high annual rate of £109,860,000.

Even more striking than the growth in production since the beginning of 1960 has been the rise in the value of orders in hand. At the end of 1959 the total of such orders stood at £55,892,000, and by the end of 1960, the figure had risen to £105,703,000. It is evident, therefore, that orders placed during the year exceeded deliveries by some £50,000,000. By the end of January there had been a further increase in the order book total to £109,132,000.

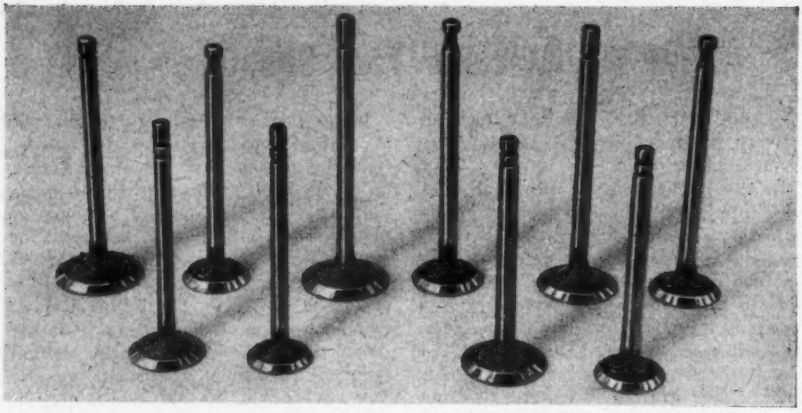
In February, however, net new orders, for the first time since the end of 1959, only slightly exceeded deliveries, so that there was little change in the value of orders in hand. It is, of course, too early to say whether the results for this month represent more than a temporary check in the exceptional rate of ordering that has prevailed, especially as the figure for new orders in January was high. Obviously, however, orders cannot continue to pile up indefinitely, since the long delivery periods that are necessarily often quoted, in the circumstances prevailing, must eventually serve increasingly as a deterrent to the placing of fresh contracts.

It has been a satisfactory feature of the revival in the demand for machine tools that has characterized the past 18 months, that it has by no means been confined to the home market. For the year 1960, the value of net new export orders placed was £32,866,000, whereas the total for export deliveries was £24,306,000. In consequence, the industry started 1961 with export orders on the books to the value of £24,297,000, which approximated very closely to the figure for deliveries in the previous year. By the end of February, moreover, there had been some further increase to £24,788,000, which may be compared with £17,301,000 at the end of February, 1960.

For the first three months of this year the value of machine tool exports (including used machines and parts) was £9,249,000 as compared with £7,458,000 in the corresponding period of 1960. It is interesting to note, moreover, that British machine tool makers continue, on the whole, to make progress in markets where machine tool building is well established. Comparing the first quarters of 1960 and 1961, there has been a decline in exports to the U.S.A. from £701,000 to £349,000, and in exports to France from £518,000 to £382,000. On the other hand, exports to Western Germany rose from £197,000 to £480,000; to Italy, from £146,000 to £538,000; and to Japan, from £116,000 to £475,00.

As would be expected in view of the very heavy demands which are being made on the British industry, machine tool imports are also tending to rise fairly rapidly, and the totals for the first quarters of 1961 and 1960 (again including used machines and parts) were £7,437,000 and £4,733,000, respectively. If used machines and parts are omitted from the totals, the excess of machine tool exports over imports for the period was £1,544,000. It is apparent, therefore, that new machine tools are now being installed in factories in this country to a value somewhat in excess of £100,000,000 per annum. This figure, which is higher than has been achieved hitherto, except in special circumstances, may be regarded as satisfactory but by no means extravagant.

Given a period of stability in which machine tool production was allowed to expand without interruption, there is no reason why an installation rate of £150,000,000 should not be reached by 1964, and at this level it should at last be possible to make some progress in overtaking the arrears of obsolete machine tool replacement.



The Quantity Production of Poppet Valves

Methods Employed by Vauxhall Motors, Ltd., Luton

By R. E. GREEN, Associate Editor

SOME DETAILS WERE GIVEN in an article published in MACHINERY, 98/808—12/4/61, of the preliminary series of operations performed on poppet valves for the engines of passenger cars and commercial vehicles made by Vauxhall Motors, Ltd., Luton. Valves of 10 different designs are made, as seen in the heading illustration, where inlet and exhaust valves for the Victor are shown at the left of the front row, and for the Velox and Cresta at the right. The valves in the rear row are for the various commercial vehicles made by the company in their Dunstable factory.

All the inlet valves, each of which have a larger head than the corresponding exhaust valve, are of 1-piece design, and all the exhaust valves are of 2-piece construction, with the exception of the valve for the Victor car. These 2-piece exhaust valves are made by flash butt welding together two lengths of bar, of austenitic and plain carbon steel, which eventually form the head and stem portions, respectively, of the completed valve. In the previous article, reference was made to cutting-off, flash butt welding, upsetting and forging operations on the head, heat treatment, and shot blasting. Here, some of the subsequent machining operations on the valves are described.

ROLL-STRAIGHTENING OF STEMS

Before machining operations on the valves are begun, the stems are straightened, to ensure that they will clean up during the removal of the small amounts of material which are allowed. The allowance on the stem of the 2-piece exhaust valve for the Velox and Cresta cars, for instance, at the right-hand end of the front row in the heading illustration, is 0·011/0·014 in. on diameter. The stem must therefore be straight within 0·003 to 0·004 in., if difficulties are to be avoided at later production stages. Straightening is performed on the Malmedie (Stuart Davis, Ltd.), flat-die, thread-rolling machine shown in Fig. 1, which is fitted with automatic loading equipment and has an output of about 52 valves per min.

At present, valves to be straightened are placed manually in the loading chute of the machine. As mentioned in the previous article, however, an extensive programme is in hand for the provision of automatic hopper and other feed mechanisms for such operations. The loading chute is seen more clearly in the close-up view of the machine, from one side, in Fig. 2, and the valves are suspended by their heads between two inclined

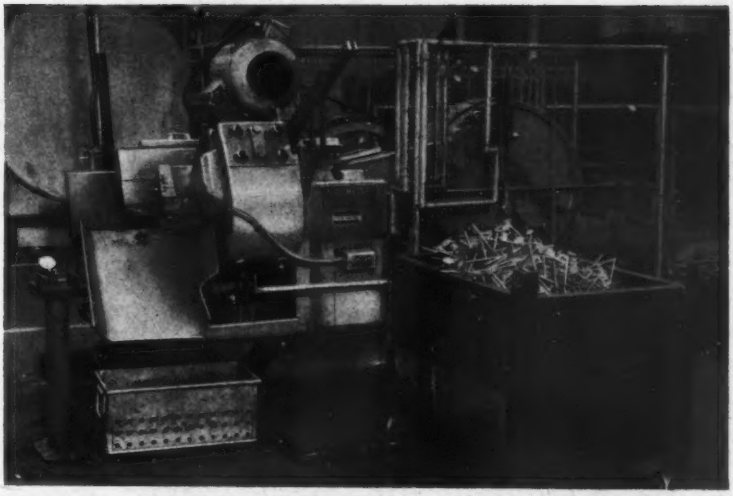


Fig. 1. General view of the Malmedie, flat-die, thread-rolling machine employed for straightening operations on heat-treated and tempered valves. Some of the guards have been removed for clarity

parallel steel bars. Valves slide down the chute to a double-stop escapement mechanism at *A*, which is linked to, and operated by, an angular feed slide at the far side of the machine. One of the two stops is advanced as the other is retracted, so that one valve is allowed to pass through the escapement at each machine stroke.

After it has been released, the valve slides down the chute to a position at which it is stopped by a fence, where it remains until the thread-rolling slide *B*, which is driven by a connecting rod from an eccentric pin on the large flywheel, returns to the starting position. As the slide again begins to move, towards the camera, the feed slide is operated to push the valve between the dies. At the same time, it actuates the escapement to release another valve. As the moving slide continues to advance, the valve is trapped between the face of the flat die plate *C*, which is of hardened steel, and a similar plate in a spring loaded housing *D*.

The dies are so arranged that there is a clearance between them to accommodate the stem, and the leading edge of the moving plate has a series of serrations. These serrations grip the stem, to prevent initial skidding and to start the valve rolling as the dies begin to pass each other. The housing *D* is carried on guide plungers near each corner, and is loaded towards the plate *C* by springs which exert a total force of 28 tons. This force is sufficient for straightening most of the valves processed. At the end of the stroke of the moving die, the valve is carried clear of the fixed plate and it falls down the chute in the foreground, into a box, ready

Fig. 2. In this close-up view of the Malmedie machine can be seen details of the loading mechanism. The moving die *C*, has a series of serrations to grip the stem of the valve during the initial part of the stroke

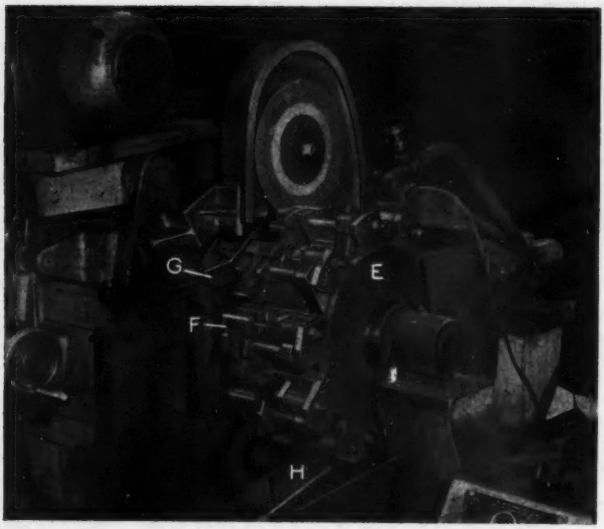


Fig. 3. This Rowland machine, for cutting off and grinding the stems to length, has two wheels to which the valves are carried in succession in the fixtures on the periphery of the continuously-revolving drum *E*

for transfer to the next machine in the line.

Certain valves, for commercial applications, are required to be left in a very hard condition, and are therefore straightened on the machine before heat treatment. Straightening of such valves after heat treatment is less effective because of the resultant springy condition of the material.

GRINDING OPERATIONS

Visual inspection follows the straightening operation, and the valves are counted before they pass to a special Rowland cutting-off and face-grinding machine, a close-up view of which is given in Fig. 3. This machine operates on the stem end of the valve to bring it to the required overall length, and it has a continuously-rotating drum *E*, which is driven at 4·5 r.p.m., and carries 10 fixtures. Each fixture has V-locations for the stem, and an adjustable end stop against which the head face is pressed when the valve is loaded. The drum rotates in a direction such that, after being automatically unloaded, the empty fixtures rise towards the operator, who stands at the left in Fig. 3.

At the lower side, each fixture has a bracket with a shaft to which is pinned a simple lever-type clamp, as at *F*. The lower end of the clamp is forced outwards by a compression spring, so that the upper, T-shaped end, is pressed against the valve stem, as the fixture approaches the first of the two grinding wheels. Before reaching this wheel, the fixture passes the spring-loaded cam *G*, which applies pressure to the end of the stem, to push the valve into the fixture until the head face is firmly in contact with the stop mentioned previously. The position of this stop determines the overall length of the finished valve, but a generous tolerance is allowed.

The first of the grinding wheels, seen at the top in Fig. 3, with the guard removed, is of Carborundum A36-S-BM4/RS2 specification, and is of the rubber-bonded type, $\frac{3}{32}$ in. thick. This wheel is employed to cut off a small portion of the material from the stem end of the valve as it is carried past in the fixture. About 0·008 to 0·010 in. is left for removal by a face-grinding operation performed by the second wheel, which is of Abrafract A60-HB19 specification, 20 in. diameter, and 3¼ in. face width.

After passing the second wheel, the valves are carried down to the unloading position. The shaft to which the clamp for each fixture is pinned extends towards the right, and is supported in a bearing at the edge of the drum. Near this bearing, another lever is pinned to the shaft, and this lever extends through a slot in the drum periphery. As it approaches the unloading (lowest) position, the lever is engaged by a cam within the drum, with the result that the shaft is turned slightly, to retract the clamp *F*. The valve is now free to roll out of the fixture on to the flat-surfaced chute *H*, whereby it is discharged from the machine.

The fixture then passes the loading position where another valve is placed in the V-locations. Subsequently the lever moves clear of the cam, and the compression spring re-applies the clamp.

AUTOMATIC WORK-TRANSFER ARRANGEMENTS

After rolling down the chute *H*, in Fig. 3, valves drop into a hopper just above ground level. One side of this hopper, which is seen at the lower left in Fig. 4, is formed by a 2-in. wide conveyor belt inside the sheet metal structure at *J*. The conveyor belt is of saw-toothed form, and is driven at a speed of about 30 ft. per min. by a

¼-h.p., Neco electric motor. Valves tend to rest against the conveyor belt because of the slope of the hopper sides, and they are picked up by the saw teeth and carried to the top of the structure. Here, each valve is delivered to a chute leading down to two inclined, parallel steel bars, so spaced that the stem passes between them, but the head is supported.

The valves pass down by gravity to a point at which they can be automatically fed to the next machine in the line, seen at the right in Fig. 4. This machine is a Landis centreless grinder, employed for semi-finishing the stem to 0·346/0·347 in., for the Velox and Cresta exhaust valve considered in the earlier article in this series.

Because the machine has an automatic dressing cycle, as will be explained, the demand for valves fluctuates, and provision is therefore made to deal with any over-supply of valves from the belt conveyor. This arrangement takes the form of a second chute *K*, also made from two parallel steel bars, which leads down to a box pallet wherein the excess supply of valves is allowed to collect, in readiness for subsequent recovery.

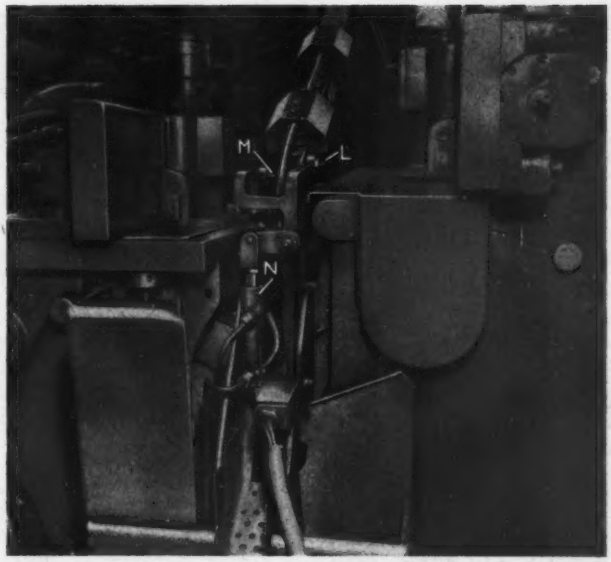


Fig. 5. Automatic loading of valves on the Landis centreless grinding machine for semi-finishing the stems, is performed by the air cylinder-operated escapement mechanism here shown

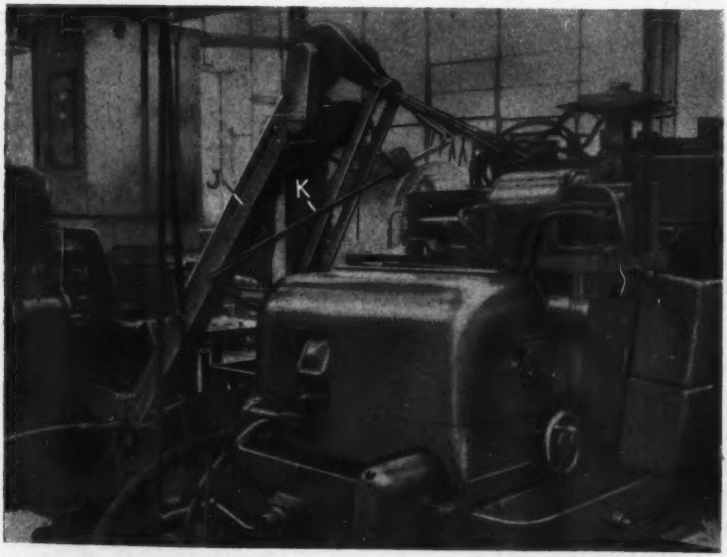


Fig. 4. View showing the conveyor whereby the valves are automatically transferred from the Rowland cutting-off machine (left) to the Landis centreless machine (right) for grinding the stems

The second chute joins the first by way of a mechanism similar to a railway points system, a pivoted rail being operated by the valves as they move past, and returned by the action of a spring.

When the chute is filled up to the position of the points, as shown, the pivoted rail cannot return, and succeeding valves are diverted down the escape chute until the level of supply in the main chute has again been reduced, and the pivoted rail is free to return.

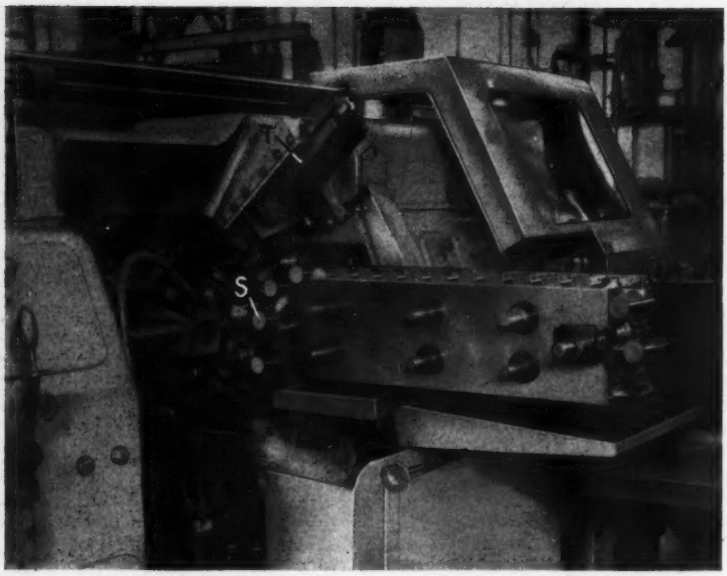


Fig. 6. Turning operations on the valve head, and semi-finishing of the seat, are performed on this B.S.A. Acme-Gridley 6-spindle automatic, in a cycle time of 9 sec., including automatic loading from the magazine

Some details of the automatic loading mechanism provided on the Landis centreless grinding machine are shown in Fig. 5, where the delivery end of the transfer chute is seen near the centre at the top. The valves move down the chute to the escapement stop *L*, which is carried on the upper end of a pivoted lever. The lever is forked, and carries another stop *M*, on the other side of the chute. A projection at the left of the pivot point of the lever is connected to a vertical air cylinder *N*, and the lever is also extended downwards, and carries another stop (not shown), just above the level of the work support.

At the end of a grinding cycle, the finished valve is ejected and air is admitted to the lower end of the cylinder *N*, causing the ram to rise and the upper end of the lever to move to the right. This action permits the next valve in the chute to move past the first stop *L*, but it is arrested by the second stop *M*. At the same time, the valve which was held up by the third stop, at the lower end of the lever, is allowed to drop on to the work support and the grinding cycle then proceeds. Subsequently, the direction of the air supply to the cylinder is reversed, to return the lever to the position shown, and allow the valve, which was held up by the second stop *M*, to move down to the third stop, in readiness for loading at the next cycle.

No in-feed movement is applied to either the grinding or control wheel on this machine. Instead, the control wheel, at the left in Fig. 5, is arranged to make one revolution per cycle, and has a cam form which provides the required amount of in-feed for the work. The fresh valve is loaded when the point of minimum radius on the control wheel is adjacent to the work support, and after it has been ground, it is unloaded by an ejector bar, operated by a direct-acting air cylinder at the far side of the machine, when the control wheel returns to the same angular position.

Dressing of the control wheel, to the required cam form, is performed under manual control, by a diamond held in a cam-controlled slide, which is mounted on a support plate pivoted above the wheel housing, as seen at the upper left in Fig. 5. As the diamond is fed past the wheel by a hydraulic cylinder, the support plate for the dresser slide is raised and lowered by a cam on the wheel spindle. During grinding, the dresser slide is held up clear of the control wheel by a threaded stud. The grinding wheel, on the spindle at the right, is of Carborundum BA 367-N5-VBLU specification, and also has a hydraulically-operated dressing slide, which is brought into use automatically after a pre-set number of valves has been ground.

At each dressing cycle, the diamond is lowered by 0·0015 in., and is traversed across the wheel, being then lowered again, by a similar amount, for the return stroke. The lowering movement for the diamond is interconnected with the feed mechanism for the wheel slide, which is automatically advanced by a corresponding amount, so that the diameter of the component produced is not affected by dressing. Normally, dressing is required after about 100 of the plain carbon steel inlet valves have been ground, or 35 of the stainless steel exhaust valves for the Victor car. Two-

piece valves cause more rapid wheel wear, and dressing is needed after about 22 valves have been ground.

The hardness of the material also affects the rate of output, the speed of the control wheel being varied to give suitable grinding times, to suit the valve material. Normal output rates vary from 10 to 17 valves per min., and, as mentioned above, the tolerance on the diameter is 0·001 in.

TURNING OPERATIONS

From the Landis machine the valves are transferred in containers to one of two pairs of B.S.A. Acme-Gridley (Burton, Griffiths & Co., Ltd.) 6-spindle, 1-in. capacity, bar automatics, arranged side by side, on which the head is turned and radiused, and the seat is turned to the required angle. One of these machines is seen in Fig. 6, and it is fitted with automatic loading equipment in the form of an indexing magazine, carried on the cross-slide. The magazine incorporates two vertical steel plates with bushed holes for shafts which support sprocket wheels for two roller chains. Links on these chains carry special U-shaped spring steel clips at intervals of about 2 in., and within each clip there is a steel block with a longitudinal V-groove.

The arrangement is more clearly seen in Fig. 7, and each clip is so designed that its sides extend above the V-block and project inwards. Thus, when a valve stem is pushed through into the V-groove it is retained in position by the clip. At the beginning of the cycle, the magazine is moved towards the machine by the cross-slide. A ratchet wheel *P*, on one end of the shaft for the outer sprocket wheel, is engaged by a spring-loaded pawl in the upper end of a lever *R*, pivoted on the same shaft. In the slotted lower end of the lever *R* is pinned a rod whereby the lever is connected to a bracket fixed to the headstock casting of the machine.

The effect of movement of the magazine towards the machine is to turn the lever *R* on its shaft. As a result, the ratchet wheel *P* is turned and the roller chains are indexed one space. The valve which occupies the position indicated at *S* in Fig. 6 is then carried forward until its axis is aligned with that of the machine spindle at the loading station. From Fig. 7 it may be seen that the valves are loaded into the magazine with their heads about 3 in. from the clips. When the magazine has been indexed, a pusher on the turret moves forward, pushing the valve at *S*, Fig. 6, for a distance of some 2 in. through the clip and into the collet chuck.

The magazine is then withdrawn, pulling the clip off the valve and providing clearance for a further advance of the pusher to thrust the valve up to a stop in the chuck. Next, the collet is closed on the valve, in readiness for indexing to the first machining position. As the magazine is moved outwards on the cross-slide, the lever *R* returns to its original position, the pawl riding over a ratchet tooth. During the machine cycle, the valve is indexed downwards from the loading position, and the next station is idle. At the second and third machining stations, the outside of the head is semi-finish and finish turned successively, and the last two stations provide for semi-finish and finish turning the valve seat, leaving about 0·005 to 0·010 in. for grinding.

Seats are turned to standard angles of 29 and 44 deg. on all types of inlet and exhaust valves.

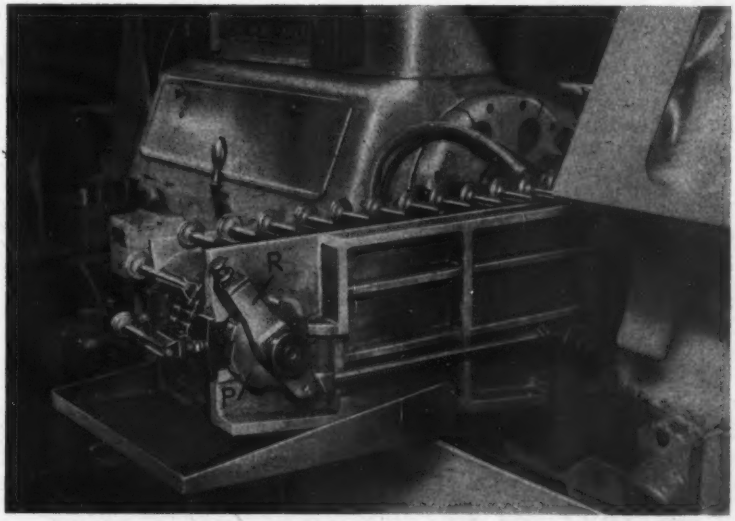


Fig. 7. Another view of the magazine on the B.S.A. Acme-Gridley machine in Fig. 6, showing details of the ratchet wheel and link whereby the valves are indexed as the magazine is moved into the loading position on its slide

Fig. 8. Designed by Vauxhall Motors, Ltd., and built by the Wavis Engineering Development Co., Ltd., this machine plunge cuts two grooves, for the collet and an oil seal, and chamfers the stem end, at the rate of 12 valves per min.

These angles, it may be noted, are measured from a plane normal to the axis of the valve stem. The slide for the finishing operation on the machine in Fig. 6 is seen at *T*, and it incorporates a separate angular slide that is fitted with a roller against which pressure is exerted by a flat face on a turret bracket, after the main slide has been moved up to a stop. A similar arrangement is employed for the semi-finishing tool at the previous station. The spindle speed is 648 r.p.m., and the cycle time is 9 sec.

When the spindle has been returned to the loading station, the collet is opened and the valve is pushed out by an ejector, and slides down a chute, out of the machine.

SPECIAL MACHINE FOR COLLET GROOVES

As may be seen from the heading illustration, each of the four passenger car valves (in the foreground) has two grooves near the stem end. The deeper groove, at the top, is for the collet projections, and the second groove is for an oil seal. Each of the commercial inlet valves (with large heads) in the background, has a single small collet groove, and the groove is plunge-turned on a battery of Britan lathes. Double grooves in passenger-car inlet valves are plunge-turned on a special automatic machine designed by Vauxhall Motors, Ltd., and built by the Wavis Engineering Development Co., Ltd., Birmingham. Each commercial exhaust valve, it may be noted, has a wide groove, which is ground from the solid because of the hardness of the stem, and this operation will be described in a later article.

On the special grooving machine, which is shown in Fig. 8, each valve is gripped by the head in a collet chuck, and for this reason, the head diameter is held within a total tolerance of 0·005 in. when it is finish-turned at the previous operation. This machine is of cast construction, and the bed supports a central spindle head and its

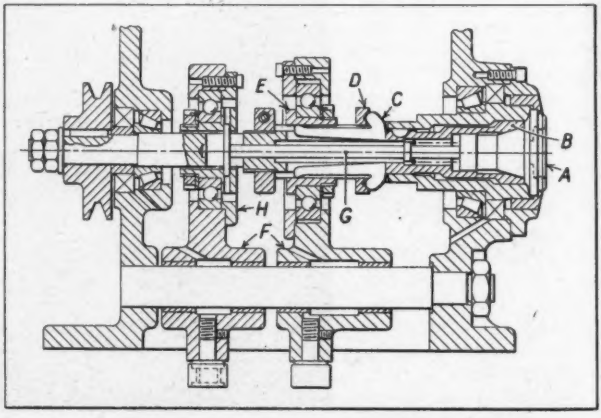


Fig. 9. Part-sectional elevation of the spindle head of the machine in Fig. 8, showing the method of opening and closing the collet jaws, and operating the ejector rod in the work spindle

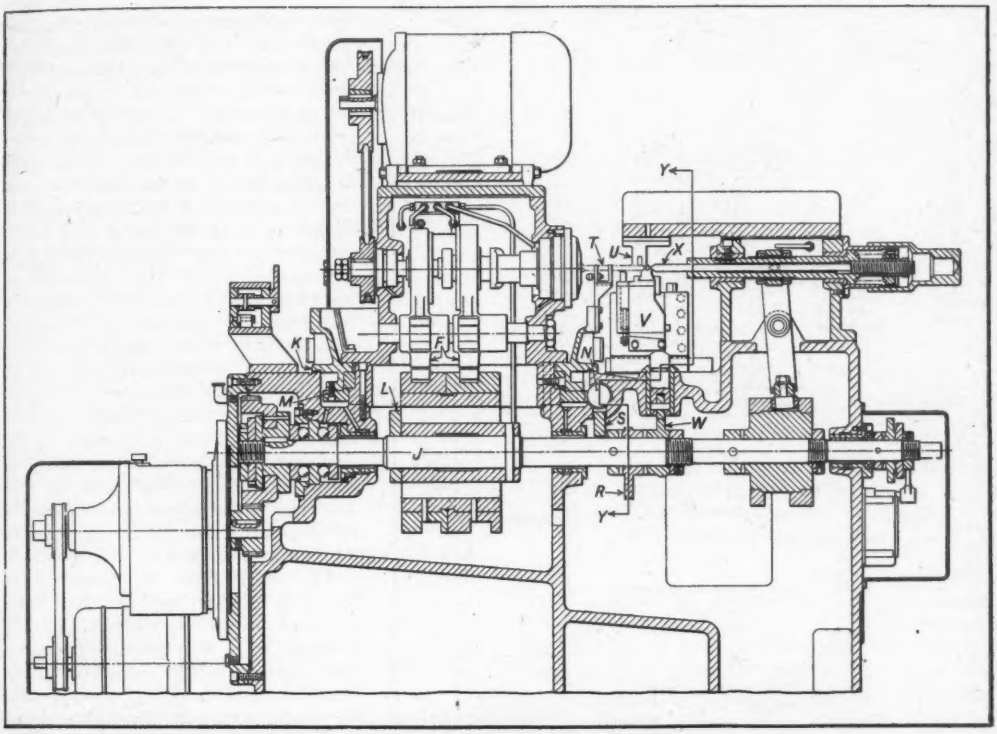


Fig. 10. In this part-sectional view of the collet-grooving machine, the camshaft *J*, which controls most of the machine movements, can be seen. Barrel cams at the left- and right-hand ends of this shaft provide for collet operation and work loading

driving motor. The spindle is driven through a V-belt at a speed of 2,400 r.p.m., and it carries a collet chuck designed to grip the head of the valve. A sectional view of the head is shown in Fig. 9, and it will be seen that the spindle is mounted in opposed taper roller bearings.

The collet *A* is held in a sleeve *B* which is tapered internally. This sleeve is keyed to the spindle, and can be moved axially, to close or open the collet, by means of the levers *C*. The heads of these levers project from slots, and are seated in a V-section groove in a ring *D*, which is fixed to the spindle. At the left-hand ends, the levers *C* are enlarged, and they are confined by the ring *E*, which is a sliding fit on the spindle. Axial movement can be imparted to the ring *E* by means of a barrel cam on a shaft in the base of the machine, through one of the members *F*, which slide on an intermediate shaft beneath the spindle.

When the valve head is gripped, the stem projects from the spindle, and the bore of the collet houses an ejector rod *G*, which is spring-loaded towards the left. This ejector is moved axially by a second ring *H*, which has a cross pin passing through a slot in the spindle. Movement is transmitted to the ejector from a second cam on the shaft mentioned above, and the two cams are so timed that the collet is opened and the ejector is advanced in rapid succession.

Some other details of the machine are shown in the vertical longitudinal section in Fig. 10, where the camshaft mentioned is indicated at *J*. Most of the movements of the machine elements are derived from this camshaft, which is driven at a speed of 12 r.p.m. by a 1-h.p. motor, through a Crofts speed reducer and gearing, at the left-hand end. At each revolution of the camshaft, a valve is grooved, so that the machine will continuously cut grooves in valves at the rate of one every 5 sec., or 720 per hour. The barrel cams for the

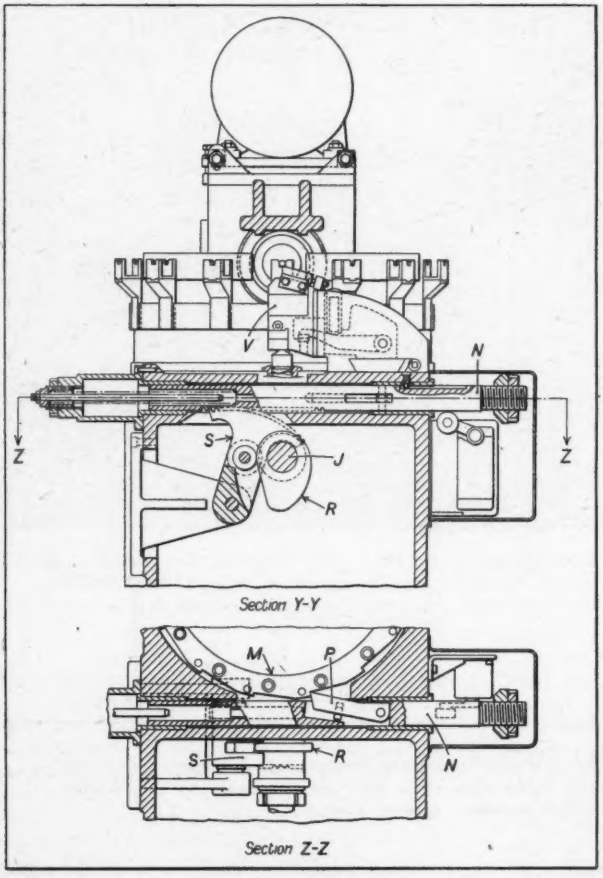


Fig. 11. Other sectional views showing the arrangement of the table indexing and locating mechanisms, also the tool slide *V*, which is raised to lift the valve during loading, and then to cut the grooves and chamfer

operation of the collet chuck and the ejector rod are seen near the left-hand end of the camshaft in Fig. 9, and their rectangular-section cam grooves are engaged by rollers on the lower ends of the members F.

Surrounding the spindle housing there is an annular table *K*—similarly identified in Fig. 8—round the periphery of which are carried 15 equally-spaced brackets. Each bracket is of U-section at the upper end, and each blade of the U has a slot of sufficient width to accommodate the valve stem. The machine was originally arranged for automatic loading of the valves, but the air-operated mechanism provided is not now in use, and the valves are therefore placed in the slots by hand from the side at which the operator is standing in Fig. 8, with their heads towards the spindle housing.

Indexing and location of the table are also effected by means of the camshaft *J*, the cam *L* being arranged to impart vertical movement to a locating plunger (not shown), through a bell-crank lever. The upper end of the plunger is a good fit in each of a series of 15 equally-spaced, bushed, locating holes in the ring *M*, fastened to the table, and this ring also has 15 equally-spaced notches cut in the periphery. One side of each notch is radial to the centre of rotation of the ring, the arrangement being shown in the two part-sectional views in Fig. 11. Here, the upper view shows a section on the line *Y-Y* in Fig. 10, and the lower, a section on the line *Z-Z*.

The notches in the periphery of the ring *M* are seen in the part-sectional plan view, also the indexing plunger *N*. This plunger carries a spring-loaded pawl *P*, in a slot, and is moved longitudinally by another cam *R*, on the camshaft, through a lever *S*, also seen in the sectional elevation. This lever is pivoted at the lower end and carries a roller which is in contact with the cam. At the upper end, the lever is of quadrant form with teeth which engage those of a rack cut in the lower side of the plunger *N*. These parts are lettered similarly in Fig. 10 and 11.

Rotation of the camshaft *J* in an anti-clockwise direction, as viewed in Fig. 11, causes the upper end of the lever *S*, and the plunger *N*, to be moved to the left by the cam *R*. This movement carries the end of the pawl *P* into contact with the radial face of one of the peripheral notches in the ring *M*, and turns the ring through 24 deg. The cam *L*, Fig. 10, which is timed to retract the table-locating plunger before the indexing cam *R* comes into operation, now advances the plunger to lock the table in the new position. Further rotation of the indexing cam *R* then allows the plunger *N*, Fig. 11, to be returned to the right by a compression spring.

As the table is indexed, a fresh valve is carried to the position occupied by that at *T* in Fig. 10,

for the grooving operation. Valves in the U-shaped slots of the table brackets are held with the stem ends inclined slightly downwards, the depth of the outer U-slot being greater than that of the inner. This arrangement allows the valve to clear the small bracket *U*, on an overarm, as it is moved into position. The stem end of the valve is raised to bring the axis into alignment with that of the main spindle by means of a single roller, carried on a spring-loaded plunger in a housing at one side of the tool-slide *V*.

This slide is raised by a cam *W*, on the main camshaft, with a dwell portion which ensures that the valve is held in a horizontal position, in contact with two steady rollers in the bracket *U* on the overarm, during the advance of the loading plunger *X*. Movement is transmitted to this plunger through a centre-pivoted lever from a barrel cam on the right-hand end of the main camshaft, and it serves to push the valve towards the spindle, so that the head enters the spring collet, which is immediately closed by its operating cam.

Further rotation of the cam *W* raises the tool-slide, slightly to increase the pressures exerted by the steadying rollers, and to carry the tool into contact with the work. The carbide-tipped tool, which may be seen in the close-up view of the machining position in Fig. 12, is of special

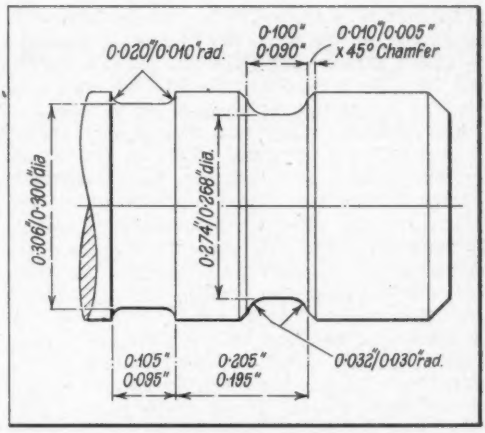


Fig. 13. Drawing showing the collet and oil seal grooves and the end chamfer on the stem of an exhaust valve for the engines of Vauxhall Velox and Cresta passenger cars

form to produce the two grooves and the chamfer at the end of the stem, and it has dovetails whereby it is clamped to a face on the slide at an angle of 15 deg. to the horizontal. With this arrangement, it is only necessary to grind the flat face of the tool at the same angle, when re-sharpening. The tool is fed straight up by the cam to plunge-cut the grooves and the chamfer, and is then immediately retracted.

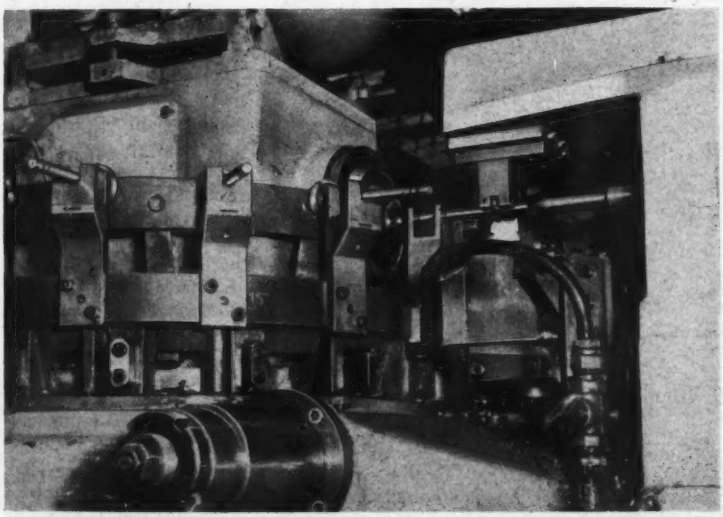


Fig. 12. Close-up view of the machining station on the collet-grooving machine showing the three support rollers for the end of the stem, and the tool slide which carries the carbide-tipped form tool at an angle of 15 deg. to the horizontal

Details of typical grooves, in the stem of the exhaust valve for the Velox and Cresta cars, are given in Fig. 13, and it will be noted that there are two grooves. As explained in the earlier article, the upper groove receives the split collet, which holds the valve spring retainer in position, and the lower groove is fitted with an oil seal. The tool is fed to the required depth, from the dwell position, in about 1 sec., by a rise

on the cam *W*. As soon as the tool has been withdrawn clear of the work, the loading plunger *X* is retracted. At the same time, the collet is opened and the valve is ejected by the rod indicated at *G*, Fig. 9.

The finished valve falls into the U-shaped grooves of its holder, and comes to rest in the inclined position with the stem end clear of the bracket *U*, Fig. 10. Successive indexing motions then carry the valve to the unloading position, which is shrouded by the sheet metal chute at the left in Fig. 8. As the valve approaches the chute, the stem end rides over a downward-sloping steel bar which raises it to a horizontal position. At the far side of the chute there is a bracket carrying a centre-pivoted lever, one end of which is connected to a single-acting, spring-returned vertical air cylinder. The other end of the lever is positioned above the projecting stem of the valve.

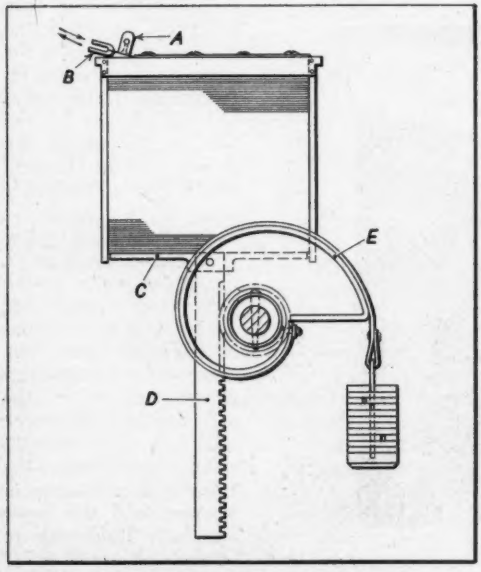
When the table moves into the machining position, a micro-switch is operated which controls the air supply to the cylinder, causing the ram to rise and lift the lever. The air supply is not restricted so that the lever is moved rapidly upwards at the cylinder end, and the other end is brought down smartly on the valve stem, causing it to pivot about the steel bar on which it rests. The valve is thus flipped into the sheet metal chute, and is discharged into a box. Should the valve pass the chute without being unloaded, it operates a second micro-switch, with the result that the current supply to the machine is interrupted and it is automatically stopped.

Further operations on valves will be described in a final article, to be published shortly in MACHINERY.

Constant-pressure Arrangement for a Magazine Feed

By RALPH T. STEWART

A magazine for holding a number of flat sheets, which are fed successively from the top of the stack by means of the vacuum lifter *A* and the gripper *B*, is shown in the accompanying figure. With such an arrangement, it will be appreciated, the stack requires to be supported from the under-side, and to be raised continuously—as the sheets are removed—so that the top item is always in the correct position relative to the lifter and the gripper. To this end, the stack is supported by a platform *C*, which is carried on top of a cylindrical rack *D*, arranged for vertical movement in bearings (not shown).



The cam *E* is turned by a weight and provides a progressively diminishing upward thrust as the number of parts in the magazine is reduced

Meshing with the rack *D* there is a pinion, which is secured to a shaft whereon is mounted the cam *E*. A flexible belt, which is wrapped round the periphery of the cam, is secured to the inner end of the form by screws, and has a weight attached to the free end. In the figure, the magazine is shown fully loaded with sheets, and it will be seen that owing to the shape of the cam the weight is acting as far as possible from the centre of the pinion. In this position, the weight is arranged to be just sufficient to over-balance the stack of sheets, thereby thrusting them against stops at the top of the magazine.

As successive sheets are removed, the balance weight will turn the cam, to raise the platform *C*. The shape of the cam ensures that the effective position of the balance weight progressively approaches the centre of the pinion. Consequently, the upward thrust imparted to the platform *C* is reduced in approximate proportion to the diminishing weight of the sheets in the magazine. A handle, not shown, is provided on the cam shaft, whereby the latter is turned in an anti-clockwise direction to lower the platform *C* when the magazine is to be replenished.

Making Components for Marine Diesel Engines

Some Examples of Set-ups and Machines Employed at the Queens Island Works of Harland & Wolff, Ltd., Belfast

By A. W. ASTROP, Associate Editor

SOME TYPICAL SET-UPS at the diesel engine works of Harland & Wolff, Ltd., Queens Island, Belfast, were discussed in an article in MACHINERY, 98/1127—17/5/61, which was mainly concerned with large, heavy-duty, machines and such components as engine bed-plates, cylinder blocks, connecting rods, and eccentric straps. Here, some other examples of machining operations are considered, including copy-turning and boring of cylinder liners on a Craven lathe, copy-turning on a Berthiez vertical boring machine, and close-tolerance grinding of the spindles and seats for fuel injectors for diesel engines.

OPERATIONS ON CYLINDER LINERS

The Craven lathe seen in Fig. 1 has a centre height of 36¼ in. and a bed length of approximately 37 ft. Sixteen speeds, ranging from 1·3 to 55 r.p.m., are provided for the spindle, which has a 17-in. diameter bearing at the nose end and a 12-in. diameter bearing at the rear. Sliding feeds range from 0·012 to 0·4 in. per rev., and surfacing feeds from 0·006 to 0·2 in. per rev., and the latter rates also apply to the power movement for the top slide. The machine is equipped for boring, with the aid of a 10-in. diameter bar, and the boring carriage has 24 feed rates, from 0·015 to 5·53 in. per min.

Facilities for copy-turning under the control of an electrically-operated stylus head and a flat-template are provided, and this equipment can be seen at the left in the figure. The steel tube *A* is supported at the right-hand end by a swan-necked bracket extending from the 3-point steady, and at the left-hand end by a bracket attached to the headstock. Both these brackets are of the half-cap type, so that the tube can readily be removed if the copy-turning facilities are not required. On the tube *A*, there is a number of split-clamp type brackets with flat, T-slotted, top surfaces whereon the template is bolted. The stylus head is held vertically at the end of a cast bracket which projects from the left-hand end of the swivel-slide.

The set-up shown in Fig. 1 provides for simultaneously boring, and copy-turning the outside surface of a cast-iron cylinder liner for a 6-cylinder marine diesel engine. Held by a 4-jaw face-plate, the liner is supported at the right-hand end by a 3-point steady. The steadies are of the roller

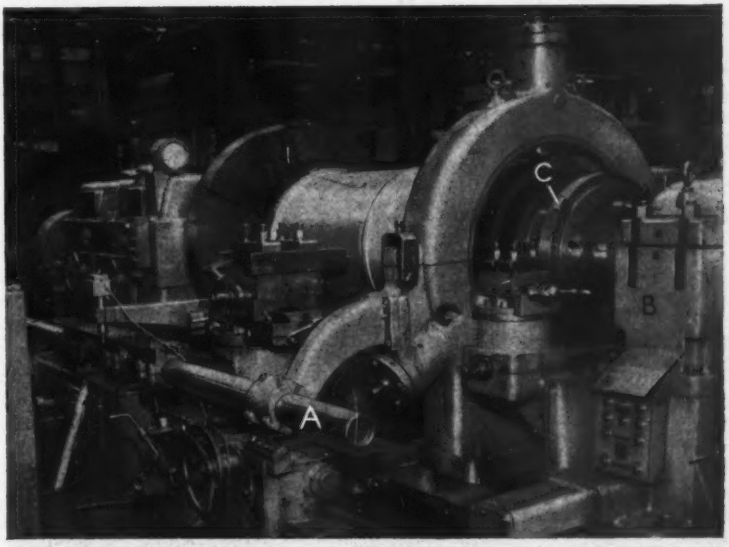


Fig. 1. This Craven sliding, surfacing and boring lathe is employed at the Belfast works of Harland & Wolff, Ltd., for combined copy-turning and boring operations on cast-iron liners for diesel engines

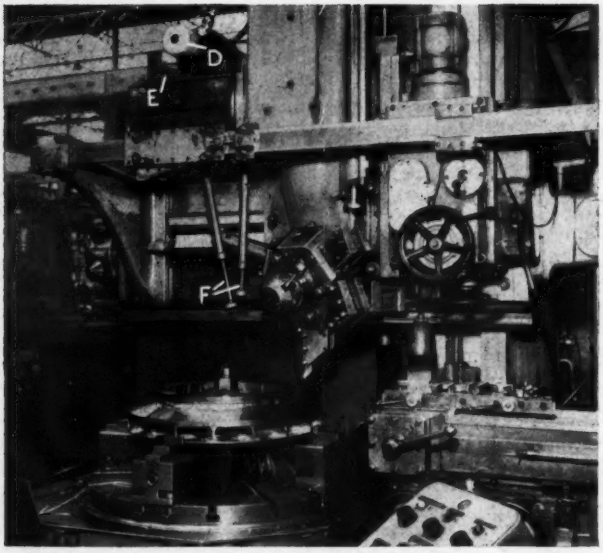


Fig. 2. Set-up on a Berthiez vertical turning and boring mill for copy-turning a weld-fabricated impeller for a centrifugal compressor

type, and are adjusted by means of screws. At the roughing stage, the periphery of the liner is turned by a single tool under the control of the copying attachment, and, simultaneously, a twin-tool head is fed through the bore, also to take a roughing cut.

High-speed steel tools are used for this set-up, and the spindle is run at 10 r.p.m. For finishing the liner, however, the turning and boring operations are performed separately, in order to avoid the possibility of either affecting the accuracy or surface finish produced by the other, as might occur if they were carried out simultaneously.

As mentioned earlier, the boring bar is fed longitudinally by a power-operated carriage, and it is supported close to the workpiece by the steady *B*. Part of the boring head is just visible in the figure, and at the rear end there is a large ring member which is slightly smaller in diameter than the hole to be bored. In this ring there are four seatings, which serve to house small pads *C*. These pads bear lightly in the bore of the liner, as it is machined, and provide an additional means of steadying the bar. It will be noted that at the left-hand end of the steady *B* there is a flat face whereon is bolted a small tool-slide. Longitudinal, transverse, and swivelling movements are provided for this slide, which is employed for facing and chamfering operations, for example, on the ends of workpieces.

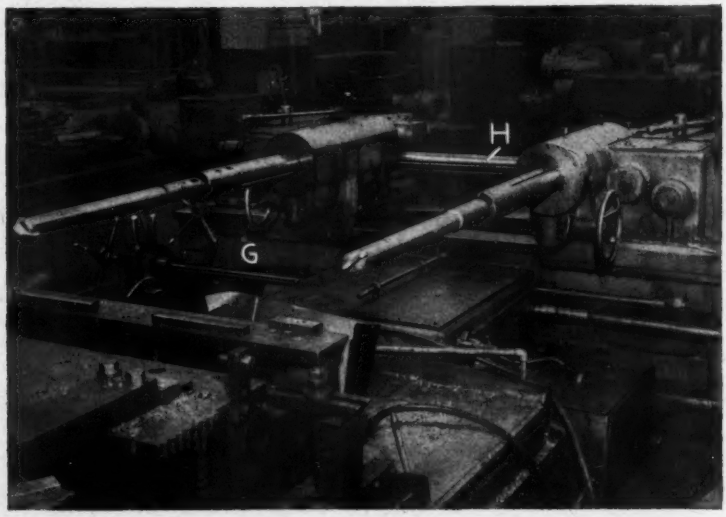


Fig. 3. Special twin-head deep hole boring machine designed and built by the company. Holes up to 5½ in. diameter by 5 ft. deep can be bored with the aid of this equipment

COPY-TURNING ON A VERTICAL BORING MILL

In Fig. 2 is shown a set-up on a Berthiez (Soag Machine Tools, Ltd.) vertical boring and turning mill, several of which are installed in the works. It is equipped for copy-turning, under the control of an elec-

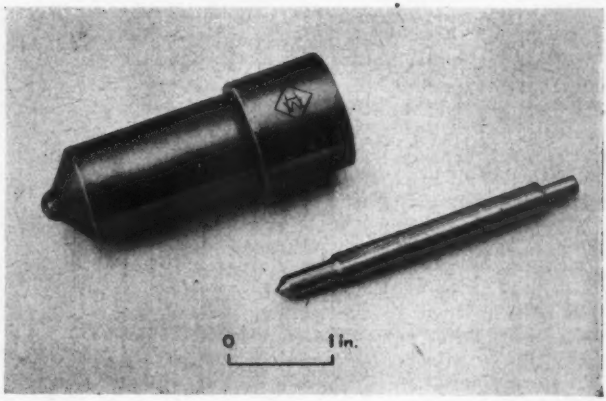


Fig. 4. Typical spindle and sleeve from the range of diesel fuel injectors made by the company for marine and industrial engines

trically-operated stylus head, at *D*, which operates in conjunction with a flat template *E*. The template is bolted to a compound slide, which is provided with horizontal and vertical movements for setting the template relative to the work, also for setting the depth of cut. These movements are controlled by two shafts, which are indicated at *F* and can be turned by hand.

The workpiece seen in position on the table is an impeller for a centrifugal compressor, and incorporates two steel forgings which form the upper and lower walls. These forgings are separated by a number of vanes, which are welded in position. The set-up illustrated provides for turning the central boss and the tapered face of the upper forging.

TWIN-HEAD DEEP-HOLE BORI G MACHINE

For certain deep-hole boring operations, the company has designed and built the special twin-head machine shown in Fig. 3, in which an existing lathe bed, indicated at *G*, is incorporated to provide a mounting and slideways for the two boring heads. On this lathe bed, the heads can be set at different centre distances, from a minimum of 1 ft. to a maximum of 5 ft., and clamped in the required positions. To the right of the machine, and not visible in the figure, there is a large gearbox which gives a range of speeds and is driven, through multiple V-belts, by a 40-h.p. motor.

The output shaft of this gearbox is connected to the right-hand end of the transmission shaft *H*, which passes through bores in both the heads and serves to drive the spindles. Power feed to the latter is derived through pick-off gears, in each head, from the shaft *H*. The workpiece is clamped to a table, a portion of which is visible in the left-hand foreground of the figure. This member is mounted on a cast-iron bed that is arranged at right-angles to the bed *H*, and has screw-operated adjustment towards and away from the spindle heads, for setting purposes. The machine will bore holes up to 5½ in. diameter by 5 ft. deep.

OPERATIONS ON PARTS FOR DIESEL INJECTORS

In Fig. 4 is shown an injector nozzle and spindle which are typical of the ranges of such compo-

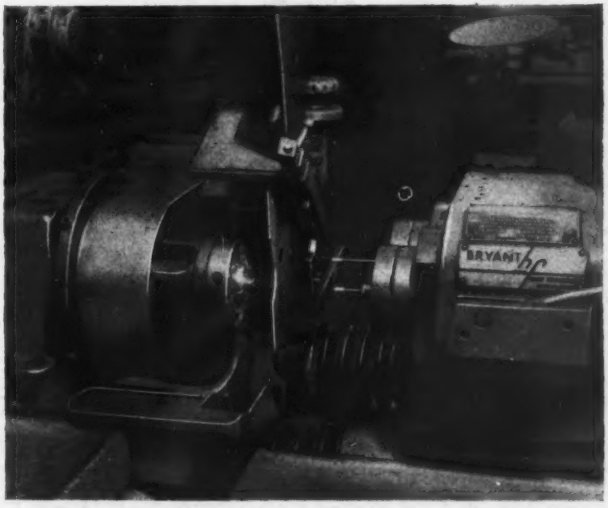


Fig. 5. Set-up on a Bryant twin-spindle machine for grinding a parallel bore and a concentric conical seating at one setting

nents which the company makes for diesel fuel injectors of various types and sizes. As is well known, the spindle must be a close sliding fit within the bore of the sleeve, and the cone-point is also required to be concentric with the parallel portion, again within very close limits. The same applies, of course, to the bore of the sleeve, and to the conical seat at the end. Operations on the bore and seat of the sleeve shown in Fig. 4 are carried out on a Bryant type 1300 W twin-spindle grinding machine (Buck & Hickman, Ltd.), which is also employed for basically similar operations on delivery valve seats.

A close-up view of the working area of the machine set up for operations on a delivery valve seat is given in Fig. 5, where a portion of the workpiece can be seen projecting from the collet chuck. This component has a 5-mm. diameter bore and a conical seating at the outer end, and both these portions are ground at the same set-up. The work-head has a power transverse movement, whereby the work-spindle can be aligned with either of the two grinding spindles, final positioning being determined by dead stops. The spindle nearer the camera is fitted with a conical wheel, and is used to grind the seat portion, and the rear spindle has a cylindrical wheel, for grinding the parallel bore.

Both spindles are of the high-frequency type,

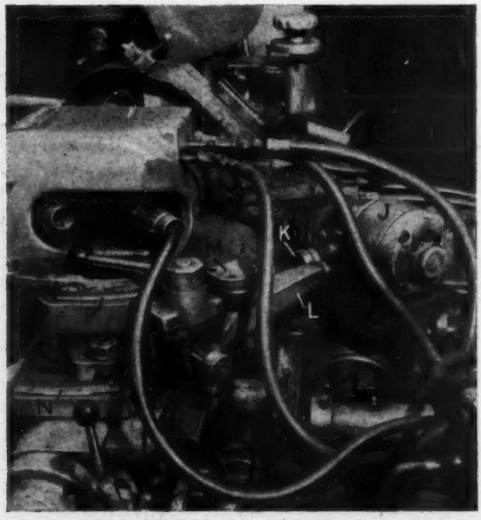


Fig. 6. For grinding conical seats, the wheel-head is reciprocated in a direction parallel to the face being ground by this power-driven eccentric and lever arrangement

Fig. 7. The cylindrical portions of injector spindles are lapped to a finish of 1·5 micro-inches on this Norton-Newall machine

and are carried in a housing which can be reciprocated longitudinally in the conventional manner, when grinding the parallel portion of the bore. For grinding the seat portion, however, the wheel-head is reciprocated in a direction which is parallel to the face being ground, and this movement is imparted by a small cam. A close-up view from the right-hand end of the machine is given in Fig. 6, and here may be seen a combined fractional horse-power electric motor and reduction gearbox *J*.

On the output shaft of the gearbox there is an eccentric *K*, which is driven at a fairly slow rate. A free-running roller, which is held in contact with the periphery of this eccentric, is mounted on the end of the arm *L*. This arm is pivoted about the bearing *M*, and as it is caused to oscillate by the throw of the eccentric *K*, the other end advances and withdraws an intermediate slide which is interposed between the spindle head and its saddle. This swivel slide can be set to the required angle, namely, one-half of the included angle of the conical seat to be ground, with reference to the arcuate scale *N*. The spindle head, in turn, is set parallel with the work-head, with reference to the arcuate scale *P*.

With this arrangement, the swivel slide and

spindle housing are reciprocated as a complete unit, in a direction parallel with the work-head spindle, when grinding the plain bore. For grinding the conical portion, however, the swivel slide and spindle housing are moved on the saddle, by means of the power-driven eccentric. Since the plain and conical portions are finished at the same set-up, close limits of concentricity are ensured.

For lapping the cylindrical portions of injector spindles of the type shown in Fig. 4, the Norton-Newall machine seen in Fig. 7 is employed. It is provided with cast-iron upper and lower lapping discs, and the workpieces are retained in a slotted carrier disc which is eccentric to the laps. The amount of eccentricity can be adjusted, and is progressively reduced to a minimum for finishing operations. A cast-iron arm which carries the upper lap can be swung about a vertical column, to the position shown, to facilitate loading and unloading the workpieces. During the course of lapping a batch of spindles, the latter are changed about in the slots, also turned end for end, to ensure even distribution of wear on the laps. With this machine, surface finishes of the order of 1·5 micro-inches are consistently obtained.

Adcock & Shipley Installation for Milling Radio-active Materials

In the accompanying figure is shown a No. 1 milling machine which has been supplied by Adcock & Shipley, Ltd., Ash Street, Leicester, for operations on radio-active materials at a British atomic power station. To ensure the safety of the operator the machine is completely enclosed, and there are various glove apertures whereby access is gained to the controls. To facilitate operation various modifications have been made.

For example, to avoid difficulties associated with speed changing, drive is taken from a 3-h.p. electric motor through a Kopp variator. Both these units are installed outside the enclosure, and a long connecting shaft passes through a running seal. This shaft was superfinished to reduce wear on the seal, and is extended into the machine base where it is supported in bearings. From a 6-groove pulley carried on the shaft, drive is transmitted to the spindle by V-belts. The Kopp variator has an output speed range from 480 to 4,320 r.p.m. and by means of the belt reduction and back gearing, spindle speeds from 30 to 2,160 r.p.m. can be obtained. The low speeds are advantageous for certain materials.

For ease of operation through the glove apertures, handwheels have been substituted for ball handles, and those for the knee and cross-slide were reversed for greater convenience. Pipes connected to the oil drain holes of the column and cross-slide gearboxes enable draining and refilling to be performed from outside the cabinet. It may also be noted that hexagon grease nipples have been fitted to permit easier use of the grease gun.

A vertical milling attachment is mounted and removed by the lifting block at the right.

Adcock & Shipley machine arranged for operations on radio-active materials

The Sprayflow Stellite Hardfacing Process

DELORO STELLITE, LTD., Highlands Road, Shirley, Solihull, Warwickshire, are now producing Stellite grades SF1, SF6, and SF12 in rod form for application by flame spraying with the Mark 33 pistol made by Metallisation, Ltd., Barclays Bank Chambers, Dudley, Worcs. The Standard Stellite grades produced for normal welding purposes have been modified to suit this new technique, and rods, which are $\frac{3}{16}$-in. diameter, are supplied in cast lengths of 2 ft.

The process is known as Sprayflow, and the deposits are alloyed to the base material by heat treatment after application, the structures, it is stated, being then quite different from those of normal sprayed metals which are mechanically bonded. Three stages are involved, namely preparation, spraying, and fusing. The method is most suitable for the deposition of thicknesses in the range from 0·010 to 0·060 in. Generally, oxy-acetylene or electric arc welding processes are used where deposits in excess of $\frac{1}{16}$ in. are required.

PREPARATION

It is usual with both new and worn components to machine down the area to be treated, as seen in Fig. 1. The ends of the undercut area should be chamfered to an angle of not more than 30 deg. as indicated at *a*. A method of preparation where the overlay is to be applied without an undercut is shown at *b*. The surface must be free from oil and grease, and machining is preferably performed without liquid coolant.

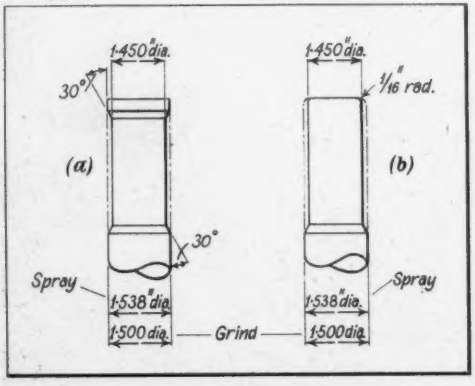


Fig. 1. Two methods of preparing a round workpiece for treatment by the Sprayflow process

The area to be treated should then be grit-blasted with 18 grade crushed abrasive and an air pressure of at least 40 lb. per sq. in. An alternative method of preparing the component is by machining a fine thread of 24 or 26 per in. pitch, but extra deposit is then necessary to fill the grooves.

SPRAYING

With the minimum delay after grit-blasting, the component is placed in a suitable position for spraying. A cylindrical part is preferably rotated in a lathe, and a surface speed of 30 to 50 ft. per min. is suitable. The Sprayflow rod is inserted in the gun as was shown in MACHINERY, 98/972—26/4/61 (Fig. 10).

Acetylene and oxygen pressures are so adjusted as to ensure a somewhat more oxidized deposit than is obtained with conventional spraying. These oxides are "flushed out" during fusing, but they assist the process by widening the plastic range.

Normally, deposits applied by the Mark 33 pistol are fine grained, the pistol being primarily designed to achieve this result. In the Sprayflow process, however, coarser and more oxidised deposits are required, which can be obtained on account of the adaptability of the wire spraying process. Apart from increasing the oxygen pressure, normal methods of spraying are used. The nozzle is held approximately 6 in. from the workpiece, and the spray is directed at right angles to the surface. It is preferable to coat the whole area with a thin film, before building up the required thickness of deposit. Spraying can be carried out manually, but if the pistol is mounted in the lathe tool-post, and the saddle traverse motion engaged, a more even and consistent deposit is obtained. The process, it is stated, is much faster than welding.

The coating shrinks during the fusing process so that an allowance of 25 per cent must be made when determining the thickness to be sprayed. Allowing 0·010 in. for grinding, an estimate for a component with a deposit of 0·025 in. would be:—

Finish ground thickness	0·025 in.
Grinding allowance	0·010 in.
25 per cent. shrinkage allowance	0·009 in.
Total thickness of deposit ...	0·044 in.

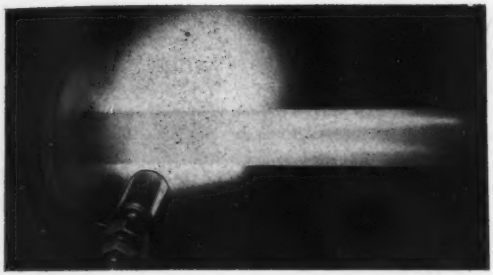


Fig. 2. Application of an oxy-acetylene torch for fusing the Stellite deposit on a round workpiece which is being rotated in the lathe

FUSING

Three methods can be employed for re-melting the fused layer, namely, oxy-acetylene torch fusing, furnace heating in a controlled atmosphere, and induction heating. The two latter are only suitable for repetition work and quantity production where close control of temperatures and time cycles can be maintained. Oxy-acetylene heating, with one or more torches according to the size of the job, is more adaptable, and is the most common method. A soft, bushy flame—neutral to reducing—gives the most satisfactory results. Special multi-jet nozzles of various sizes are available which avoid the risk of local overheating that may occur with single jet nozzles. Fig. 2 shows the fusing operation in progress on a round workpiece which is being rotated in a lathe.

Before fusing is started, the work is gently but thoroughly preheated by applying the torch over the whole area of the deposit until a temperature of 400 to 450 deg. C. is reached. The flame is then concentrated at one edge of the deposit until the plastic range is reached, which is indicated by the appearance of a mirror-like glaze. The torch is then moved slowly along the workpiece to fuse the whole sprayed area. It is important not to exceed the upper limit of the plastic range, otherwise flowing or sagging of the deposit may occur. As in spraying, rotation at a suitable speed considerably facilitates uniform fusing. The effect of the fusing operation is to bond the deposit metallurgically to the base metal. At the same time, the layer is transformed from a porous condition, as sprayed, to an impervious continuous coating.

As soon as the component has been completely fused, it must be cooled slowly in a bed of Kieselguhr or powdered asbestos. If cooling is too rapid, cracks may form in the deposit.

Sprayflow deposits are usually finished by grinding, and for this purpose a Norton 37C-54-J5V wheel, or its equivalent, is recommended. It is advisable to remove the bulk of material by taking cuts with the edge of the wheel, and to use the face of the wheel for the finishing cut. The wheel should be dressed frequently to maintain an open surface.

Alternatively, a deposit of SF6 Stellite can be machined to size with tungsten carbide tools. A top rake of 5 deg. is suitable, and feed rates up to 0·010 in. per rev. may be employed.

The Sprayflow process with Stellite rod may be applied successfully to any steel of welding quality that can be coated by the gas or electric arc methods. Base metal dilution is stated to be negligible, and Stellite may readily be deposited on stabilized 18/8 stainless steel, Nitralloy steel, and free-cutting steels. The fusion process is rapid, and the work is subjected only to low temperatures for short periods of time, so that grain growth and other structural modifications are reduced to a minimum. Moreover, there is less likelihood of thermal cracking, and "difficult" materials may be treated with greater confidence than if deposits are applied by welding.

VISUAL INSPECTION OF COILED LAMP FILAMENTS.—It is reported in a recent issue of the *Philips Technical Review*, a journal which deals with technical problems, products, processes and investigations within the Philips companies, that a system is employed by the Philips Lighting Division, Eindhoven, Holland, whereby coiled filaments for incandescent lamps are inspected visually as they leave the coiling machine. The filament is inspected while it is moving and before it is cut into the required lengths. A microscope is focused on the coil as it leaves the machine and serves to produce an enlarged image which is viewed by a vidicon television camera. In closed circuit with this camera there is a receiver, which incorporates a cathode-ray screen with long afterglow characteristics.

On this screen, the image remains bright enough to be observed for about 10 to 15 sec., although the coil is illuminated by flash for only a very short period (10μ sec.). This short-period illumination is necessary to "freeze" the coil, which is moving rapidly and would otherwise present a blurred image. The flash is under the control of the inspector, who presses a button to illuminate the coil at frequent and regular intervals. It is suggested that the system is suitable for the visual inspection of other types of moving parts and where a viewing time of 10 to 15 sec. is acceptable.

Adaptation of a Centreless Grinder for Formed Work

By F. E. PAYNE

In Fig. 1 is shown a perspective view of a form truing attachment of simple design, applied to a plain centreless grinder, for producing workpieces of the type seen at *X* and *Y*, in Fig. 2, the former being a waisted stud, and the latter a machine handle. A truing diamond *A* is carried in an arm *B*, pivoted in a bracket *C*. The latter is secured by screws in the existing diamond truing arm of the machine, indicated at *G*, which can be traversed across the wheel face, and swung upwards clear of the working area.

A ball stylus *D*, carried by the arm *B*, engages a template *E*, made from steel plate, which is mounted in place of the normal work rest. To hold the stylus in contact with the template, a spring is provided on the stud *F*. For the work to be performed, the small error resulting from the difference in the distances of the stylus and diamond from the pivot point of the stylus arm was of no consequence, but if greater accuracy is required, the template form can be corrected.

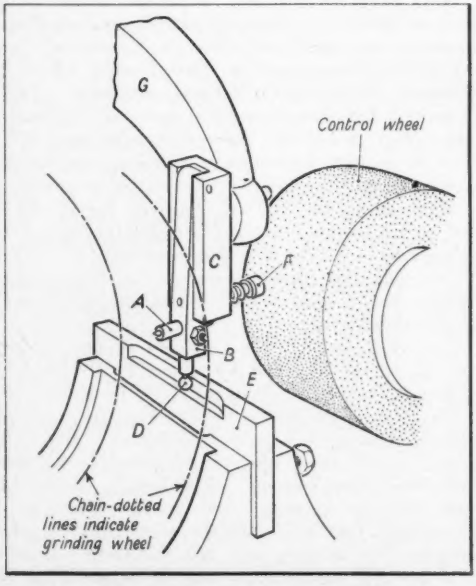


Fig. 1. Perspective view showing the form dressing attachment and template in position

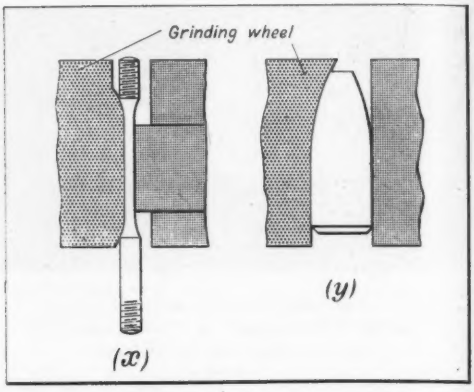


Fig. 2. Examples of formed workpieces for which the wheel is dressed by the attachment shown in perspective in Fig. 1

In setting up for truing the grinding wheel, the former plate and swinging arm must be so positioned as to take full advantage of the travel of the diamond—in this case about ⅜ in.—to ensure that the required depth of form can be obtained. Having adjusted these two units correctly in relation to the grinding wheel, their positions should be noted, to facilitate subsequent dressing operations. The height of the diamond is usually determined by an adjustable stop screw, in the truing arm of the machine. For re-aligning the template form with that on the grinding wheel, a measurement can be taken with a rule from the end of the template to some convenient point on the work rest base.

The in-feed of the diamond between truing passes is applied by means of the attachment handwheel, which is turned more than would normally be required because of the reduction resulting from the pivoted arm *B*. When grinding is being carried out, the workpiece can be located axially by the standard backstop, or by a suitably positioned pin in the work plate. Since the control wheel requires to be dressed far less frequently than the grinding wheel, it is advisable to carry out this operation first, to avoid the necessity of

disturbing the special attachment for form truing.

For the machine handle, a heavy chamfer or lead was produced on the blank to assist grinding, and the top edge of the work plate was formed to the required finished shape to provide maximum support. Although the stud was ground from the solid quite satisfactorily, provision was subsequently made for rough turning the waisted form, in order to reduce the time required for the grinding operation.

Arrangement for Remote Pre-setting and Control of Linear Motion

By HIDEO SUZUKI

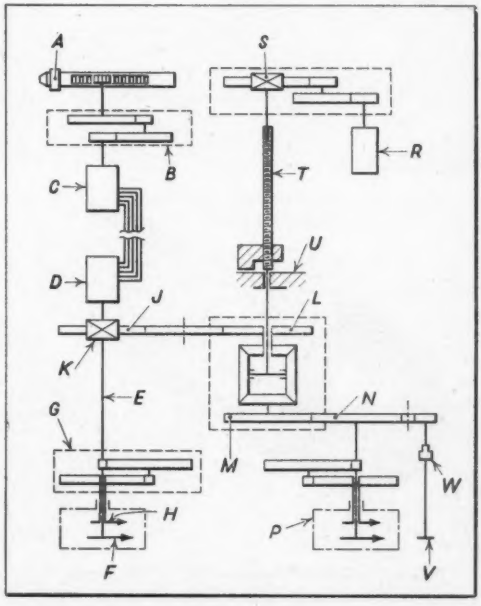
In the accompanying figure is shown, diagrammatically, an arrangement whereby the length of linear motion of a spindle quill, tool-head, or work-table, for example, can be pre-set from a remote position. The arrangement also provides for displaying the distance already travelled by the moving member at any given time. For purposes of explanation, the moving member in the figure is shown as a spindle quill, and is indicated at *A*. Attached to one side of the quill there is a rack, in engagement with a pinion. This pinion serves to drive a gearbox *B*, the output shaft of which is connected to a transmitting synchro *C*.

The receiving synchro *D* is connected by way of its output shaft *E* to the pointer *F* of a dial-type instrument, the casing of which is indicated by a chain-dotted line. On the shaft *E*, there is also a small pinion, which drives reduction gears within the casing *G*, and the last gear in the train is coaxial with the shaft *E* and serves to operate a second pointer *H*, of the dial-type instrument. It will be appreciated that rotation of the transmitter synchro *C*, derived from the rack and pinion drive on the quill, causes exactly similar rotation of the receiver synchro *D*, also the shaft *E* and the pointer *F*. The reduction gearing in the boxes *B* and *G* is such that one complete revolution of the pointer *F* represents a linear movement of 0·10 in. of the quill, and one complete revolution of the pointer *H* represents 10 in. of linear movement.

A gear *J*, mounted on the shaft *E*, is arranged so that it can either turn freely on that member, or can be locked to it by means of an electro-magnetic clutch *K*. Under the latter condition, drive from the gear *J* is transmitted, by way of an idler, to the gear *L*, which forms part of a differential mechanism with an output gear *M*. From the gear *M*, drive is transmitted by way of gear *N*, to a further set of reduction gears and a twin-pointer dial-type instrument which is identical with that already described.

To pre-set the required distance through which the quill *A* is to travel, the motor *R* is started (under the control of a hold-to-run push-button), and drives the screw *T*, through a reduction gearbox and a magnetic clutch *S*. On this screw there is a nut, which is initially in contact with the datum face *U*. The other end of the screw *T* is connected to the planet portion of the differential unit.

Provision is made for locking the gear *L*, with the result that when the motor *R* is started not only is the nut driven along the screw *T*, but the latter also serves to drive the instrument *P*, by way of the differential. When the pointers on the latter indicate the required pre-set travel for the



An arrangement for pre-setting and monitoring linear motion of a spindle quill is here shown diagrammatically

quill *A*, the motor *R* is stopped and the nut will then have been moved a certain distance along the screw *T*. If required, the pre-setting operation can be carried out manually, by means of the handwheel *V*, which, through a dog-clutch *W* and gearing, serves to turn the screw *T*. For this method of setting, the clutch *S* must be de-energized and the gear *L* must be locked, as for the motorized system.

The mechanism is thus set to provide for a predetermined length of travel for the quill, and before the drive to the latter is started, gear *N* is locked and gear *L* is released. As the quill advances, drive from the receiver synchro *D* is transmitted to the screw *T*, by way of gears *J* and *L*, and the nut moves towards the datum face *U*. When it contacts the face, an electrical circuit (not shown) stops the spindle drive motor. During the forward travel of the quill, its position is continuously indicated by the pointers *H* and *F*.

New Contact-less Switch

Developed by Servo Consultants, Ltd., 10 Bouverie Place, London, W.2, the unit shown in Fig. 1 is known as a type 400 transistorized cam pick-off, and can be employed in place of a conventional switch. It has the advantage, however, that it incorporates no moving parts. Moreover, it does not come into contact with the cam, or other moving member, which operates it. As a result,

Fig. 1. Transistorized cam pick-off developed by Servo Consultants, Ltd. Performing the same duties as a conventional switch, the unit has no moving parts and does not make contact with the actuator

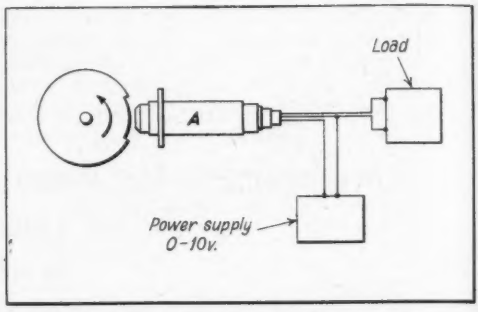


Fig. 2. A typical application of the unit shown in Fig. 1, in conjunction with a rotating cam

the working life is claimed to be exceptionally long since normal wear is completely eliminated.

In Fig. 2, which shows a typical application, diagrammatically, the pick-off is indicated at *A* and the actuating member is a cam. Almost any type of moving member can be employed as an actuator, provided that it is made from a magnetic material. In Fig. 2, the pick-off is shown connected to a "load," which may be a relay, solenoid, or counter, for example. The pick-off has two states, namely, "on" and "off," and for the former the gap between the end of the unit and the actuator can vary between 0·001 and 0·030 in. In the "off" condition, the gap must be greater than 0·25 in. The unit will remain indefinitely in the "on" or "off" condition, and is capable of changing from one state to the other at frequencies up to 1,000 per min.

The accuracy of resolution is stated to be ±0·020 in., which is equivalent to approximately 25 min. of arc on a 6-in. diameter cam. Originally designed for incorporation in high-performance electro-hydraulic servo systems, the unit is stated to have wider applications as a limit switch, or synchronizing switch, for use in connection with various types of automatic machinery, including machine tools, batch counting equipment, and process control.

Electrical connection between the unit and the load is by a 3-wire system, normally by way of an aircraft-type plug and socket. The type 400 shown in Fig. 1 is particularly intended for operating electronic equipment, in which a relatively high impedance is acceptable. For controlling electromechanical systems, requiring higher power, the type 401 pick-off is available, and a third type of unit—the 402—is claimed to be particularly suitable for operating fast electronic counters and logic stages, for example.

Quantity Production of Stainless Steel Bodies for Coffee Percolators

By P. J. KIRCHER*

AT ONE OF THE WORKS of Landers, Frary & Clark, New Britain, Conn., U.S.A., automatic electric coffee percolators are made in very large numbers. To facilitate the production of a new stainless-steel Coffeematic, a considerable amount of additional equipment was recently installed. This extra equipment was required partly because the design involved the production of components of different shapes, and partly because stainless steel is considerably more difficult to draw and shape than is the copper previously largely employed. In particular, problems arose in connection with the production of the percolator body, despite the fact that it was designed to simplify forming, since the total depth of draw is 9⅛ in. and the diameter is only 4⅝ in. near the bottom. Flaring and beading are required at the top. Fig. 1 shows the body as it appears after successive press operations.

* Landers, Frary & Clark, U.S.A.

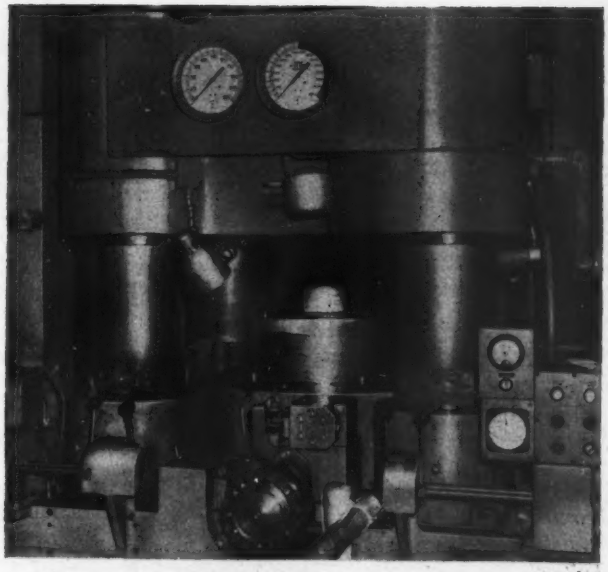


Fig. 2. After the first Hydroform operation, the cup-shaped part is 4½ in. deep with an inside diameter of 5¼ in.

Fig. 1. The percolator body as it appears after successive press operations

Four major dies are required for drawing the body, and annealing is carried out after the work leaves each of the first three dies. In addition, some local annealing is required for beading. This treatment is necessary because the AISI Type 302 stainless steel employed is not easy to draw and work hardens considerably during each press operation.

The production sequence starts with semi-automatic spray

lubrication of the 15⅝-in. diameter, 0·025-in. thick blank on a motor-driven turn-table. Castor oil is applied to the top face only, which will be in contact with the rubber diaphragm on the press. After the operator has placed the blank on the turn-table he presses a button to start the table drive and the spray gun. Both stop automatically after a pre-set time, which suffices for the application of a thin film of lubricant.

With the sprayed blank lying on the bottom tool of a Cincinnati Hydroform press, the machine is started and the cycle is completed automatically. During this cycle, the punch moves up from the lowered position and presses the blank against a rubber diaphragm. Hydraulic pressure of 2,000 lb. per sq. in. is applied above the diaphragm, to press the centre portion of the blank around the punch as it moves upward. When the punch has completed its stroke, a pressure of 9,000 lb. per sq. in. is applied for a set period. This stage completes the initial drawing operation, which produces a wide-flanged cup 4¼ in. deep, with an inside diameter of 5¾ in., as in Fig. 2. About

Fig. 3. Bright-annealed stainless-steel cups, some of which are for electric percolator bodies, are here seen leaving the cooling chamber of the furnace on a continuously moving wire-mesh belt. An atmosphere of dissociated ammonia is maintained in the furnace chamber

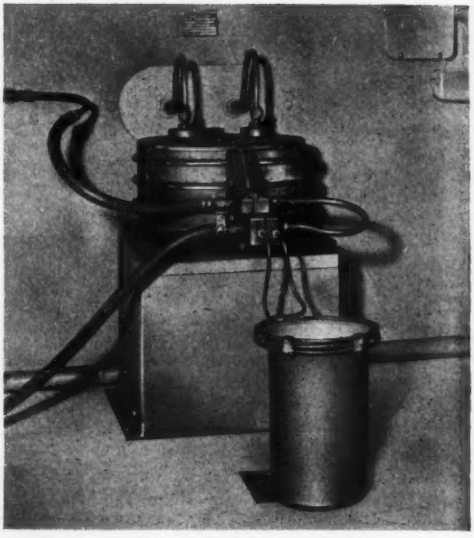


Fig. 4. Two induction-annealing operations, carried out with the equipment shown here, facilitate 2-stage spinning of the bead at the top of the percolator body

90 pieces per hour are produced on one press.

Little or no thinning of the metal occurs during the first draw. Often, however, the flange does not remain flat. In this event, it is struck in a separate flattening die after the piece has passed through an alkaline spray and has been bright annealed. This same washing operation is carried out before each of the two subsequent annealing treatments.

Annealing is performed in the continuous type Sargeant & Wilbur furnace seen in Fig. 3, which is supplied with an atmosphere of dissociated ammonia. The parts, loaded on to a wire-mesh belt conveyor by hand, pass through a curtain of burning gas, which serves to exclude air, on their way to the heating zone. A temperature of 1,950 deg. F. is reached before they enter the cooling zone, where it is reduced to about 200 deg. F. Belt speed is set to carry the parts through a complete furnace cycle in 25 min. Use of the ammonia atmosphere keeps the parts bright and free from scale.

Following this first annealing treatment, the parts are passed to a press that flattens the flange (if necessary) and then, after relubrication, are returned to the Hydroform press where the second draw is made. This draw yields a cup 7⅛ in. deep,

with an inside diameter of 5¾ in. as before. In Fig. 1, the cup is shown as it appears after these first two drawing stages, also after several subsequent operations, two of which involve deeper draws. Trimming to length on a lathe, washing, and re-annealing the workpieces precede these later operation stages.

Both the remaining draws are performed on a Bliss double-acting press, the first increasing the depth to 8 in. and forming a step at the bottom. During the last draw, the lower portion of the cup is given a slight straight taper, and a belled out portion of 5¼ in. diameter is formed at the top, in readiness for final trimming and beading. In addition, the depth is increased to 9½ in. Prior to final trimming, the bottom of the body is struck by embossing tools on a pneumatic drop stamp to form one circular rib and four short radial ribs, for stiffening purposes.

Rolling of the lip bead around the top of the body is completed in two stages, each performed on a lathe equipped with rollers of suitable contour, which serve as spinning tools. Before each of these operations, the bead area is annealed by local induction heating, as seen in Fig. 4. Such heating is rapid and results in only slight oxidation, which is subsequently removed by passivating and polishing. Beading is carried out to form a smooth rim that is easily cleaned and of a diameter to suit the apron of the cover. To ensure the necessary close fit, the neck of the component is finally sized with a horn die on a press.

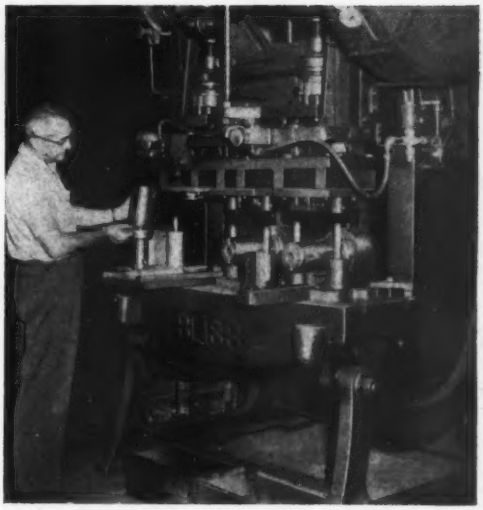


Fig. 6. With this 3-die set-up on a Bliss press, all the required holes are pierced and some of the embossing operations are performed. The bodies are advanced manually from one die to the next

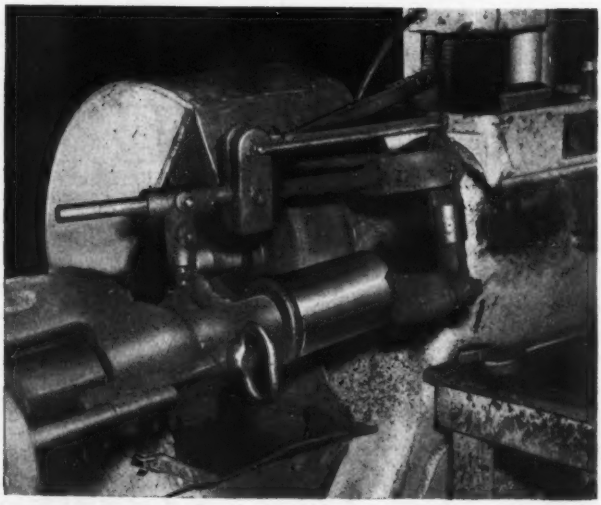


Fig. 5. For the first of two polishing operations on the exterior surface of the body, a rag wheel is employed with 280-grit emery and grease

After the beads have been polished, the bodies are placed on mandrels that are rotated and reciprocated on Divine machines as seen in Fig. 5. The exterior surfaces are polished with 280-grit emery and grease on one machine, and with 320-grit emery and grease on a second, both equipped with rag wheels. Similar machines are those employed for buffing the surfaces to a high lustre, using a Leerock compound.

A Bliss press, Fig. 6, is equipped with three sets of dies for piercing all holes. Percolator bodies are passed to each of the three dies in turn. In the die at the left, a large hole is pierced for the heating well. The two remaining dies have horizontal horns over which the bodies are slipped. Punches at the first of these stations form two bosses, while another pierces the upper boss for the top handle screw. A fourth punch forms a lower boss to which the head of a handle screw is subsequently welded.

Four punches employed with the

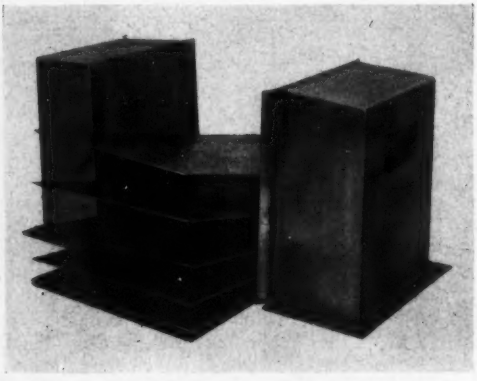
third die are shaped like the numerals 4, 6, 8, and 10 and are located within the spout area. While indicating the number of cups that will be brewed, they also form the openings through which coffee flows from the body into the spout. Another press equipped with a horn die is used to emboss a Universal loop design on the side of the body.

After completion of the percolator body, a stamped stainless steel spout assembly is brazed in position with Eutec No. 157 wire, which gives a joint that matches the colour of the steel. The hand-torch brazing is carried out with the work held in a fixture and town's gas and air is employed. A flux containing glycerin and hydrochloric acid is applied with a brush. Subsequently, the spout is hand polished and buffed to match the body finish.

The flat heads of two threaded studs are resistance-welded to the bottom of the body for fastening the thermostat assembly, and a third stud is welded at the boss for the lower handle fastening. Spout joints are then checked under light air pressure, using a soap solution to indicate any porosity or leakage. A rotary scratch brush and No. 180 aluminium-oxide grit are employed to impart a satin-like finish to the inside of the body.

Magnetic Sheet "Floaters"

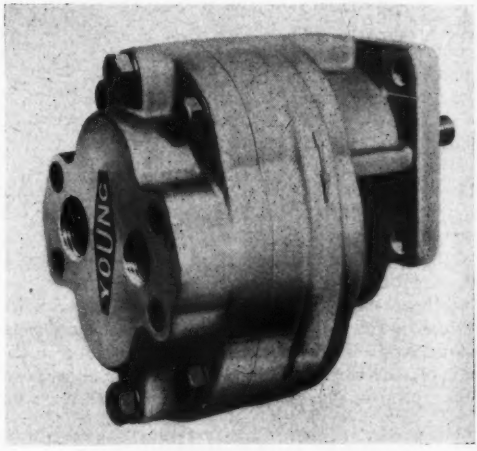
Magnetic "floaters," as shown in the figure, for separating thin, oily steel sheets to facilitate hand feeding to presses, have been introduced by Rapid Magnetic, Ltd., Lombard Street, Birmingham, 12. Such flotation, it is pointed out, may be of particular assistance if sheet edges are burred as a result of a previous stamping operation, and avoids the risk of damage to tools caused by feeding double sheets. Alcomax magnets are employed and it is stated that sheets of a wide variety of sizes and shapes can be handled in thicknesses up to about 12 gauge. For large rectangular sheets, the floater units may be concentrated at one corner.



Steel sheet "floaters" introduced by Rapid Magnetic, Ltd.

Young Hydraulic Gear Pumps

A new range of constant-displacement hydraulic gear pumps, for continuous or intermittent operation, has been introduced recently by Joseph Young & Sons, Ltd., Kay Street, Bolton, Lancs., in four sizes with capacities of 12·5, 18, 24 and 30 gal. per min. at 1,000 r.p.m. Either side or end ports can be provided, and the units, which have square mounting flanges, are interchangeable. An example is seen in the figure.



Typical Young hydraulic gear pump

The alloy steel gears, which have teeth of a special, deep form, are case-hardened and ground, and the shafts are mounted in needle roller bearings. Deeply-grooved ball bearings provide for axial location, so that there is no thrust between the gears and the cheek plates, and in accordance with the company's normal practice, the design of the latter members is such that the pressures at either side of each gear are equalized. A system of grooves in the end cover ensures that oil is not trapped at the roots of the gear teeth, and the direction of rotation can be reversed simply by inverting the end cover. The body of the unit may be of high-duty aluminium alloy or close-grained cast iron.

Balata Belting

By F. E. WINSTANLEY*

THE BALATA BELT, when it was introduced in 1885, was intended as a substitute for flat leather transmission belting, and in this role it gained immediate success. Apart from being cheaper, it offered certain definite advantages, and in spite of later competition from rubber transmission belting, the demand for balata increased steadily until after the first world war. With the twenties came the V-belt, developed to meet the new requirements of electric motors and short-centre drives. In the traditional field of flat transmission belting, however, balata has continued to hold its own.

The reason for the satisfactory performance lies in the properties of balata itself. After it has been washed and freed from impurities, the natural gum contains a hydrocarbon (trans-polyisoprene—essentially identical with the hydrocarbon in guttapercha) and resin in approximately equal proportions. This mixture provides an unusual material, which is flexible but extremely tough and resistant to abrasion. Moreover the resin contains a natural antioxidant which renders balata largely immune to the deteriorating effects of air, water, weathering and ageing generally.

For balata belting, a long staple cotton duck is impregnated with the gum. This duck provides the necessary tensile strength while the balata affords protection from internal and external friction and from chemical deterioration. In consequence balata belting is unusually robust, and will withstand much hard wear and rough treatment.

Some of the advantages of balata belting are associated with the fact that the gum with which it is impregnated is thermoplastic and not vulcanized. Belts are thus comparatively easy to repair or make endless on site, without the need for vulcanizing units. A satisfactory splice can often be obtained with balata solution and a hot iron. Moreover, the gum remains flexible at low temperatures, so that balata belts function well in refrigerating plants. They are, however, not normally recommended for conditions where the ambient temperature rises appreciably above 90 deg. F., although special belts are available for use in steam-laden atmospheres and in the tropics at temperatures up to about 100 deg. F.

Except in high temperatures, balata will give good service wherever flat transmission belting is required. There is also a form suitable for V-drives. In general, the strength which impregnation with balata confers on long-staple cotton renders this belting especially useful for heavy drives or where irregular stresses or sudden shocks occur, for example, in connection with pumps, woodworking machines, grinders, crushers, reversing drives, presses, and rolling mills. Because of the good resistance to oxidation, moreover, it is particularly valuable out of doors, in brick works, quarries, saw mills, and on construction sites, also on all kinds of agricultural machinery.

Balata has a high co-efficient of friction and provides a very satisfactory driving surface. This surface is maintained by the thermoplastic nature of the gum, which tends to feed forwards by capillary attraction during use, to keep the duck permanently covered. Incipient slipping at once raises the temperature and accelerates the flow of the gum. Belt dressings are rarely needed—indeed their use is undesirable. If, as a result of dust or maladjustment, belt-shine does develop, it should only be necessary to apply a few drops of castor oil.

Balata belting, because it is thermoplastic, is limited to speeds of about 5,000 ft. per min. The accompanying table shows the maximum horsepower transmitted per inch of width for belts of various ply thicknesses (fabric weight 33½ oz.). These figures relate to horizontal drives with pulleys of approximately equal diameter, and angles of contact not significantly less than 180 deg. For vertical drives, quarter-twist drives, and

HORSE-POWER TRANSMITTED BY BALATA BELTING PER IN. OF WIDTH (FABRIC WEIGHT 33½ OZ.)

Speed of belt, ft. per min.	3-ply	4-ply	5-ply	6-ply	7-ply	8-ply	10-ply
500	0·68	0·96	1·23	1·51	1·80	2·05	2·60
1,000	1·36	1·92	2·45	3·02	3·60	4·10	5·20
1,500	2·04	2·88	3·68	4·53	5·40	6·15	7·80
2,000	2·72	3·84	4·89	6·05	7·20	8·20	10·40
2,500	3·40	4·80	6·12	7·56	9·00	10·25	13·00
3,000	4·08	5·76	7·34	9·05	10·79	12·30	15·60
3,500	4·76	6·72	8·57	10·57	12·60	14·36	18·20
4,000	5·44	7·68	9·79	12·07	14·39	16·40	20·80
4,500	6·12	8·64	11·00	13·55	16·19	18·46	23·60
5,000	6·50	9·48	12·07	15·00	17·69	20·20	25·00

* Chairman, British Association of Balata Belt Manufacturers.

belts which are run with the tight side at the top, some allowance has to be made. For crossed belt drives, on the other hand, where the arc of contact exceeds 180 deg., power capacities may be slightly increased.

Of recent years, balata has been increasingly used for conveyor and elevator belting. Here, its resistance to weathering and its ability to carry wet loads are important advantages, together with its strength, uniformity, flexibility and dimensional stability. Typical applications are again found in quarries and saw mills, and it may be used, for example, for moving wet sand or wet gravel, or carrying wet bricks to a kiln. Occasionally, it is required to work entirely under water for such purposes as shifting mud on a Malayan tin dredge, and collecting granulated iron obtained by the new process which produces a more convenient form of raw material—for some purposes—than pig-iron. In addition, balata conveyor belting with a dry white surface, or sometimes with a p.v.c. cover, is very suitable for use in the food industries, and in cigarette-making factories for the transport of tobacco.

Balata is also used for a number of products other than belts, including door straps on motor cars, anti-squeak bonnet tape, lifting slings, cable hangers, pulley lagging, lug straps, and for cold water valve joints.

All balata belting supplied by reputable British firms conforms to British Standard 2066:1953. This specification lays down tests and standards for elongation and tensile strength of the fabric, for adhesion between the plies, and for tensile strength of the finished belt. Two weights of fabric are recognized, namely 31 oz. and 33½ oz., these figures representing the weights of samples 42 in. wide and 36 in. long. Any width from ½ in. to 72 in. can be manufactured, in thicknesses varying from 2 to 12 plies. The usual stock range covers about sixty sizes from 1 to 12 in. wide, and from 3- to 8-ply. Maximum working tensions for power-transmission, conveying, and elevating purposes should not exceed 25 lb. per in. of width per ply for 31 oz. fabric, or 30 lb. per in. of width per ply for 33½ oz. fabric. For other applications, working tensions up to 45 lb. and 50 lb. per in. of width per ply may be permissible.

M.T.E. Contactors with Time Delay

Contactors in a new range introduced by M.T.E. Control Gear, Ltd., Leigh-on-Sea, Essex, are intended primarily for motor starting, with direct-on-line, star delta, and auto transformer arrangements, for example, also for use in heating, lighting, and other circuits where a period must elapse before auxiliary contacts are operated. When the tractive coil of a unit is energized, it loads a tension spring whereby drive is provided for a Swiss-made, self-starting, jewelled escapement mechanism. At the end of a pre-set period, a single-pole change-over switch is operated, which incorporates contacts rated at 5 amp. at 250 volts a.c. This period is adjusted by means of a self-locking screw, and the entire switching mechanism, which is seen—with the protective cover removed—at the left-hand side of the typical unit here illustrated, can be supplied for delay periods ranging from ¼ to 10 or 3 to 60 sec.

M.T.E. series UC2/D contactor, with time delay attachment

Designated series UC2/D and UC3/D, the contactors are of the open type, and are available in 2- and 3-pole forms, with a total of eight capacities, for carrying maximum loads from 15 to 150 amp. at 600 volts a.c. The double-break main contacts are of silver, silver-tungsten, or silver-cadmium oxide, depending on the rating and application. Up to four instantaneously-operated auxiliary contacts, which are rated at 10 amp. at 600 volts a.c., can be incorporated, and may be of either the normally-open or normally-closed type. The UC2/D unit measures 5½ by 5⅝ by 4, and the UC3/D, 8¾ by 7 by 5¼ in., and the weights are approximately 4¾ and 12¾ lb., respectively.

Russian Machine Tools at the Leipzig Fair

By R. E. GREEN, Associate Editor

MACHINE TOOL EXHIBITS in the large and ornate Russian permanent pavilion at this year's Leipzig Spring Fair* constituted what was probably the most ambitious display so far arranged by that country's export organization, Vsesojuznoje Exportno-Importnoje Objedinenije "Stanko-import", the headquarters of which are at 32-34 Smolenskaja-Sennaja Place, Moscow G-200. As seen in Fig. 1, the display was arranged in the central aisle of the pavilion, which has a total area of about 129,000 sq. ft., and covered about one-sixth of this space.

The exhibits included two in-line transfer machines for operations on diesel engine bearing caps of cast iron, and light alloy oil filter housings, in addition to 18 standard and special machine tools. Several of the machines were installed above eye level so that the tooling areas could not readily be observed.

Although most of the machines were connected to the power supply and could be demonstrated, they were put into operation only intermittently, and visitors appeared to be discouraged from approaching too closely. Demonstrations, although readily carried out on request, were often rendered less effective by the shortage or absence of components, which permitted non-cutting cycles only to be shown. The arrangements were, however, better than in previous years, which may indicate that more serious efforts will be made in the immediate future to compete for Western markets.

The transfer machines mentioned were run regularly, with components in position, for about five minutes in each hour, and large crowds gathered to listen to running commentaries in German describing the operations, given over loud-speaker systems. In addition to machine tools, machines for electric welding by the carbon dioxide, inert gas, and submerged arc processes were shown, suitable for making butt, angle, and lap joints in material from 0·078 to 1·18 in. thick.

In this article—and in another that will be published shortly—reference is made to some of the more interesting of the single machines on view, and the two transfer machines will be described in a subsequent article in MACHINERY.

HYDRAULIC COPYING LATHE WITH PROGRAMME CONTROL

The type 1722 Pl hydraulic copying lathe, shown in Fig. 2, is built by the Ordzonikidze plant in

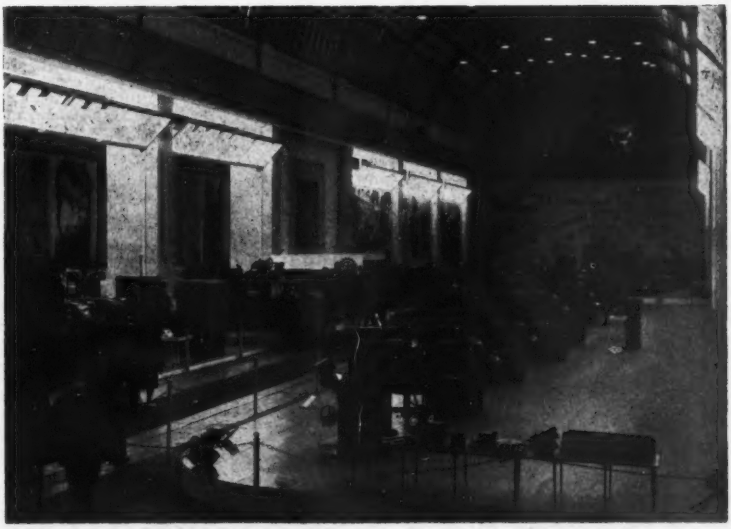


Fig. 1. This general view of the interior of the ornate Russian permanent pavilion at the Leipzig Fair shows the arrangement of the machine tool exhibits, which occupied a prominent position in the central aisle

East German exhibits at the Fair were described in MACHINERY, 98/939—26/4/61, 98/1006—5/5/61, 98/1074—10/5/61 and 98/1119—17/5/61.

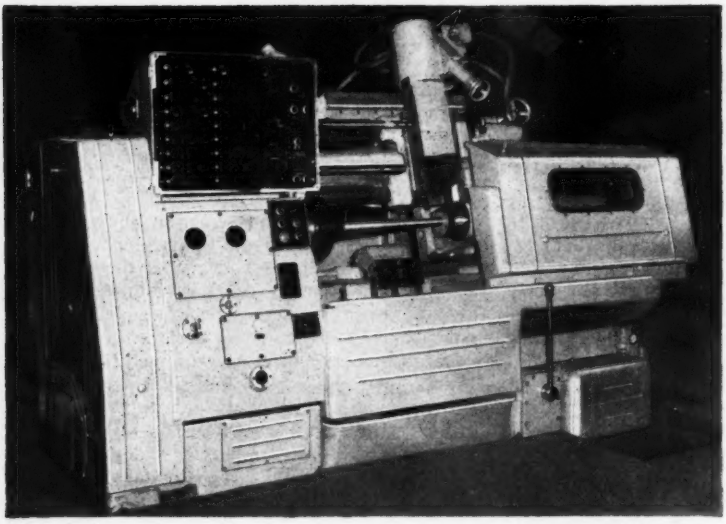


Fig. 2. On this type 1722 P1 automatic copy-turning lathe, the hydraulically-operated copying slide is mounted on a bridge casting above the spindle, and two plunge-turning slides for facing and grooving operations, beneath it

Moscow (MACHINERY, 93/137—16/7/58), and is a further development of the machine shown at the 1958 Leipzig Fair, and briefly described in MACHINERY, 92/1477—20/6/58. With a capacity for workpieces up to 19·92 in. diameter, the lathe is built with two bed lengths to accommodate shafts 31·49 and 49 in. long—the shorter capacity machine being illustrated—and diameters up to 7·87 in. can be turned. Drive is taken from a main motor of 37·5 h.p. in this instance, and there are 14 spindle speeds ranging from 71 to 1,410 r.p.m.

The copy-turning slide is carried on rectangular-section ways on a massive bridge casting above the spindle, and has a total cross movement of 4·3 in. A hydraulic pump, driven by a 6-h.p. motor, provides power for the movements of the copying slide, which can be traversed longitudinally at steplessly-variable speeds from 0·78 to 27·56 in. per min. The slide is moved transversely, under the control of the copy-turning mechanism, by a hydraulic cylinder mounted above it, and is arranged at 90 deg. to the work axis. A template behind the slide determines the work form, and provision can be made for mounting several templates which are indexed in succession to enable a series of cuts to be taken during the cycle.

Beneath the spindle there are additional guideways on which plunge-feeding slides can be mounted to provide for turning shoulders and undercuts, and these slides also are hydraulically powered. The spindle can be fitted with a cam-jaw or an air-operated chuck, and the tailstock quill is operated hydraulically.

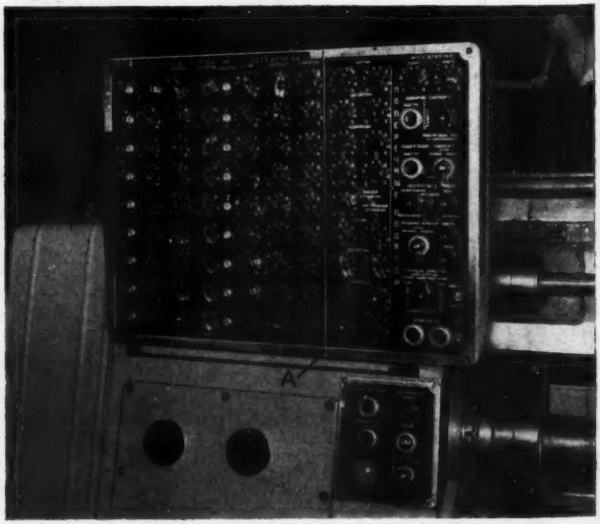


Fig. 3. The control panel on the lathe in Fig. 2 provides for setting the diameters and lengths of longitudinal travel for a maximum of nine separate passes of the main slide, also for the movements of the facing slides

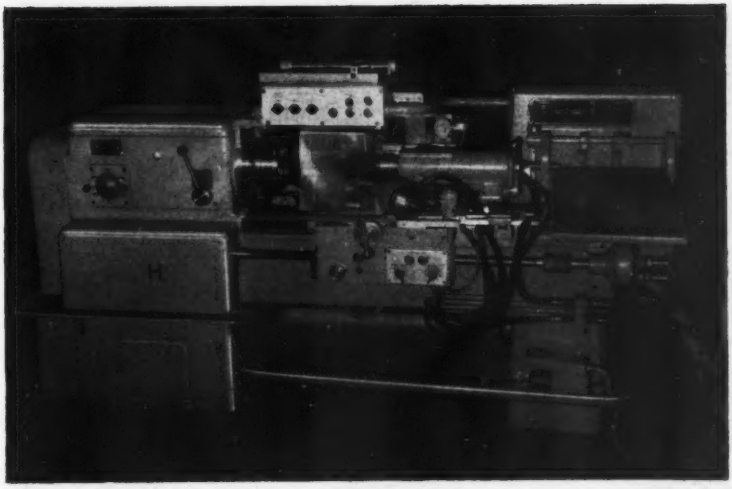


Fig. 4. A variant of the 1K62 centre lathe, this 1C62 machine is equipped with automatic loading and unloading and copy-turning equipment for the production of shaft components

Equipment is provided on the machine which enables the movements of the copy-turning slide to be controlled by setting switches on the large panel above the headstock. A close-up view of the panel is given in Fig. 3, and there are nine horizontal rows of selector switches at the left of the vertical line *A*, each line comprising eight switches. These rows provide for the automatic selection of nine successive cutting movements of the copying slide, when the latter is not under the control of the template. Of the vertical columns of switches, the first four from the left-hand side of the panel provide for setting the different diameters to be produced, and the second four columns, the lengths between shoulders.

Consequently, these switches provide for the control of the transverse and longitudinal movements of the slide, to enable straight stepped forms to be produced without the need for a template. The rows of switches are marked to indicate their functions, and those controlling the diameters can be set to produce millimetre dimensions in hundreds, tens, units and fifths. Length settings in hundreds, tens and units of millimetres can be made with the adjacent columns of switches. By means of these switches, therefore, stepped shafts with any number of diameters up to nine can be rough-machined to an accuracy of 0·02 mm. (0·008 in.), and a final finishing pass can then be taken, if required, with the tool controlled by a template.

Two further rows of switches, to the right of the vertical line *A*, provide for setting the limits of movement of the plunge-forming slides, and are also marked in hundreds, tens and units of millimetres. Switches and push-buttons at the extreme right-hand side of the control panel provide, for example, for single and repeat cycles, use of the copying slide, rapid traverse, opening and closing of the chuck and operation of the tailstock for loading and unloading, and selection of hand-controlled movements of the slides for setting purposes.

COPYING LATHE WITH AUTOMATIC LOADING EQUIPMENT

The type 1C62 lathe shown in Fig. 4 is based on the standard 1K62 machine built by the Krasnoi Proletarii factory in Moscow, and both these machines (described in MACHINERY, 95/300—19/8/59 and 98/1146—17/5/61) were exhibited. The basic lathe will swing 15·75 in. over the bed, and is made with three bed lengths to admit 27·9, 39·4 and 55 in. between centres. On the standard machine, the maximum diameter which can be swung over the slide is 8·6 in., and on the special lathe shown, workpieces up to 5·9 in. diameter by 23·6 in. long can be hand-loaded. When the automatic loading and unloading equipment is employed, the capacity of the machine is reduced to 2·36 in. diameter by 14·56 in.

Drive to the spindle is taken from a 13·4 h.p. motor, through gearing, and 12 speeds, ranging from 200 to 2,000 r.p.m., are selected by means of levers on the front of the headstock. Steplessly-variable feed rates from 3·9 to 19·68 in. per min. are provided for the saddle, which is guided on vee and flat ways, and the hydraulically-operated copy-turning slide is mounted on the cross-slide at an angle of 30 deg. The saddle is traversed by a ball screw, driven from the tailstock end of the bed by a hydraulic motor, and the tailstock quill and the loading mechanism are also operated hydraulically. Pressure oil for these functions is provided by a floor-mounted pump

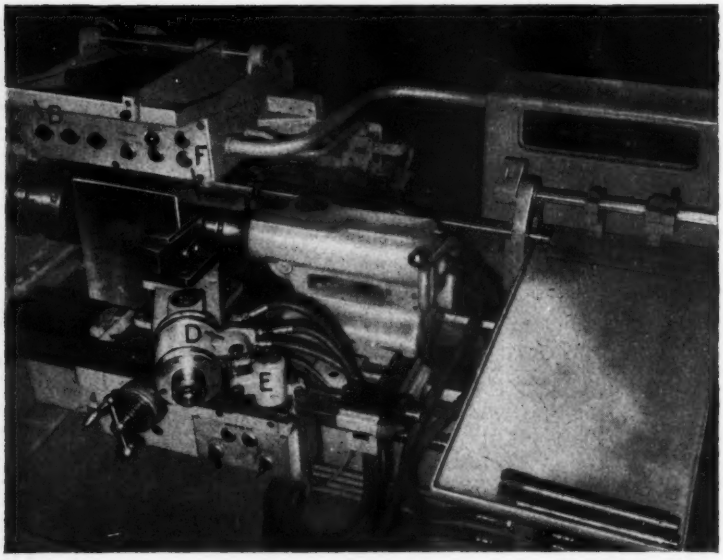


Fig. 5. Close-up view of the 1C62 machine showing details of the loading and unloading equipment. Shafts placed in the magazine *B*, above the spindle, are moved down to the loading position by a pivoted arm

unit, drive being taken from a 7·5-h.p. motor.

Some details of the automatic loading equipment, mounted above the machining position, are seen in the close-up view, Fig. 5, which also shows the copying slide, and, at the right, the tray on to which the finished components are discharged. Shafts to be turned, which have previously been cut to length, faced and centre-drilled, are loaded into the magazine *B*, which has an inclined lower surface so that they roll down towards the rear. At the lowest point, the magazine has an opening of sufficient size to permit the largest shaft within the capacity of the loading mechanism to pass through.

This opening is closed, during the loading operation, by the curved upper surfaces of a quadrant-shaped loading arm, which is pivoted on a shaft at the rear of the machine bed, as seen in Fig. 6. At the front end, the curved portion of the arm is cut-away to form a groove, into which the lowest blank descends by gravity when the arm is moved to the position shown, and is there retained by spring-loaded fingers. The arm is moved by the hydraulic rotary actuator *C*, which turns the shaft on which it is carried, and at the beginning of the automatic loading sequence, the blank is carried into alignment with the machine spindle axis.

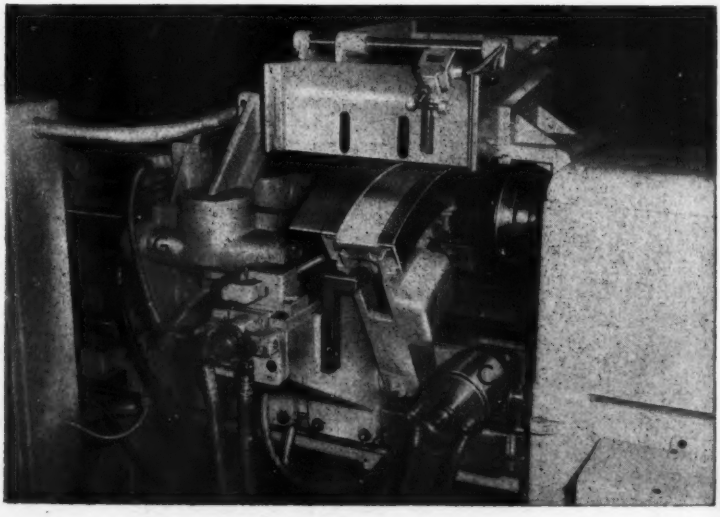


Fig. 6. In this view from the rear of the 1C62 machine can be seen the loading arm. It is mounted on a shaft which is turned by the hydraulic rotary actuator *C* to carry the shaft to the loading position in alignment with the spindle axis

Fig. 7. Bars up to 0·98 in. diameter can be turned on this 6-spindle automatic, type 1A225-6, which is the smallest of three sizes made by the Ordzonikidze machine tool factory. No special cams are required for the tool slides

With the fresh blank in position, the hydraulically-operated tailstock quill is advanced, to engage the centre hole and push the shaft into the air-operated chuck, against the pressure of a spring-loaded centre. The chuck is then closed, and the loading arm is returned to the position shown in Fig. 6, so that the next blank descends into the groove. The machining cycle now starts, and provides for successive cuts along the blank under the control of two templates, which are mounted one above the other on a holder at the front of the bed.

The lower template, which is employed for roughing, projects slightly more than the upper, finishing, template. Selection of the template to be used is accomplished automatically by means of the auxiliary cylinder *D*, at the outer end of the copying slide. The ram of this cylinder projects towards the camera and is connected to a lever which is integral with the cylindrical body of the stylus holder *E*. A projection on the right-hand side of the body carries the stylus. For the roughing pass, the ram of the cylinder *D* is moved towards the tool end of the slide, and turns the stylus-holder in a clockwise direction, with the result that it is lowered by a cam to a level at which the stylus engages the lower template.

At the end of the roughing pass, the slide is returned to the position shown, and the cylinder *D* is again actuated to turn the stylus-holder in an anti-clockwise direction, and thus raise the stylus to the height of the upper pattern. The finishing pass is then taken, the copying slide is returned to its original position, and the spindle is stopped.

Another hydraulically-operated slide is now advanced from the rear of the machine, to carry a grooved holder into position directly beneath the finished component. Next, the chuck is opened and the tailstock centre retracted, to allow the component to fall into the grooved holder, and the slide is then retracted to its original position to enable the loading sequence to be repeated. In Fig. 5, this grooved holder is seen at *F*, and in the retracted position, the groove is aligned with another groove in a fixed member at the right. Above this fixed member there is a transfer slide, operated by a hydraulic cylinder within the housing *G*, Fig. 6, the ram of which carries a rack.

The rack meshes with a pinion in the circular housing above the cylinder, and the pinion meshes with another rack on the transfer slide. This slide extends to the left in Fig. 5, above the grooved holder *F*, and carries a pusher which is in line with the finished component in the groove. When the slide is moved to the right in Fig. 5, the finished component is pushed out of the unloading slide into the groove in the fixed member, and finally into a shallow groove in the flat surface behind the unloading tray at the right.

Above this flat surface there is a horizontal shaft which is supported in a bearing bracket at each end and connected by a linkage to the shaft turned by the rotary actuator for the loading arm. This horizontal shaft carries two levers, and when it is turned, during the advance of the loading arm, these levers push the finished part forward, off the flat surface, and it rolls down to the front of the tray. The movements of the loading and unloading mechanism are controlled by solenoid

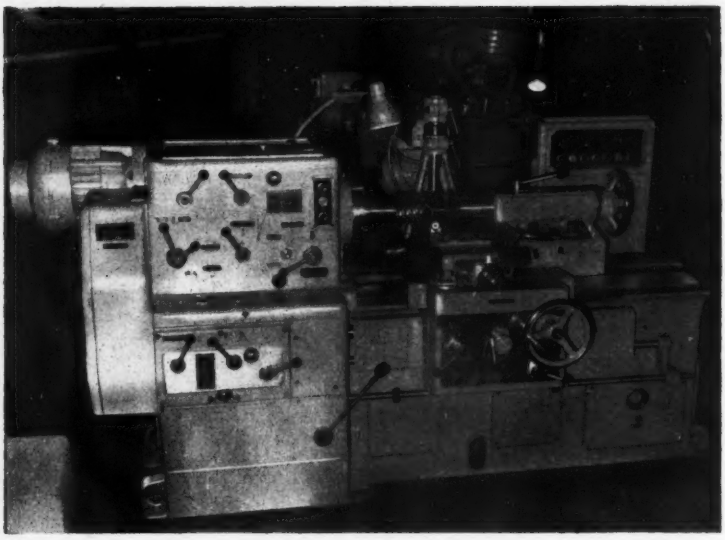


Fig. 8. Relieving operations on hobs and milling cutters, also thread cutting, can be performed on this type 1811 lathe

valves and switches, operated by a motor-driven cam which makes one complete revolution for each loading and unloading sequence.

To control the various steps in the automatic machining cycle, there is a copper-surfaced drum beneath the cover *H*, Fig. 4, which replaces the normal feed gearbox. The drum, of 9·8 in. diameter by 5·9 in. wide, is driven at slow speed, through reduction gearing, from the feed-shaft. Within the bore of the drum, which has a wall thickness of about 1 in., there are contacts whereby connection is made to a current source of 110 volts, and the periphery of the drum is covered with a strip of insulating material.

Holes punched in this strip permit contact fingers outside the drum to touch the copper surface, and electrical circuits are thus completed with the various solenoid valves and relays which control the sequence of operations during the automatic cycle. We have been informed by the Russian Trade Delegation in this country that the production of the standard 1K62 lathe, referred to above, is currently 40 per day.

SIX-SPINDLE BAR AUTOMATIC

The type 1A 225-6, 6-spindle, bar automatic, shown in Fig. 7, has a capacity for bars up to 0·98 in. diameter, and supplements the two existing machines of this type built by the Ordzonikidze machine tool factory, mentioned earlier. These two machines, it may be noted, are of 1·57- and 2·5-in. capacity. Of conventional construction, with the main camshaft carried in a bridge member which connects the gearbox with the headstock, the machine is driven by a motor of 18·7 h.p., and has spindle speeds ranging from 280 to 2,560 r.p.m., obtained by means of change gears. A Geneva mechanism provides for indexing the spindle drum, and the positions of the spindle bores and of the locating slots, it is stated, are held to 0·0006 in. During indexing, the drum is lifted clear of the locating surfaces by 0·011 to 0·015 in., to prevent wear, and is locked in position, after completion of the movement, by a double-acting mechanism. Tool-slides at each of the spindle positions are carried in heat-treated guideways on the face of the spindle drum housing, so that chips can fall clear. Quadrant-linkage mechanisms, in conjunction with three interchangeable cams, provide for the movements of the tool-slides, so that no special cams are required.

Attachments with independent feed arrangements, and auxiliary spindles for threading operations, can be fitted to the main tool drum at the two upper spindle positions. For setting, the camshaft can be driven by a separate electric motor, operated by push-buttons on the control panel, and there is a high-speed drive, engaged by a friction clutch, which speeds up the camshaft during non-cutting portions of the cycle. Indicators are fitted at both sides of the machine to show the angular position of the camshaft, and the machine is controlled by a single lever which is also duplicated at the rear. A screw-type chip conveyor continuously discharges swarf from the base of the machine.

AUTOMATIC RELIEVING LATHE

A product of the Kuibyshev machine tool works, the type 1811 automatic relieving lathe in Fig. 8 was shown set up for operations on a single-start

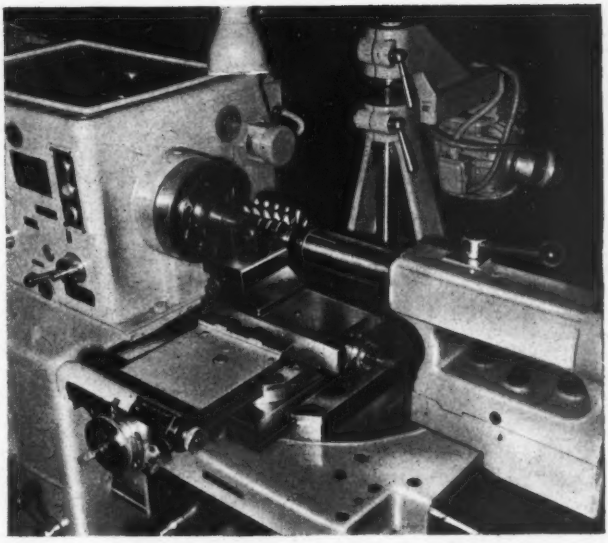
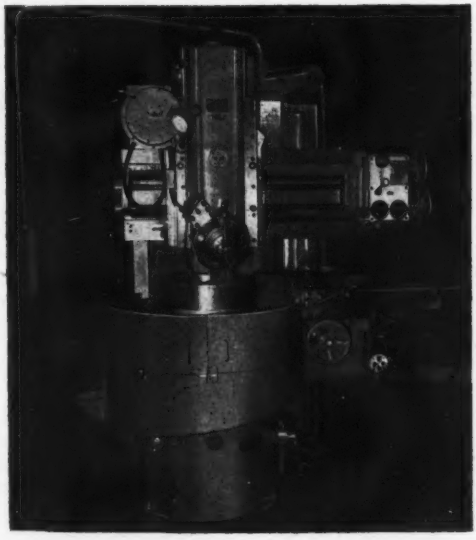


Fig. 9. Increments of cut of 0·0016 in. can be applied by the hydraulically-operated mechanism at the front of the tool slide on the type 1811 relieving lathe. Form-relief grinding can also be carried out with an attachment on the cross-slide, which is driven by the motor at the rear

hob of about 3 in. diameter by 4 in. long. The machine has a capacity for work up to 9·5 in. diameter by 8 mm. module, and can also be used for thread-cutting operations. There is a choice of 10 spindle speeds, from 2·8 to 63 r.p.m., which are selected by means of levers on the headstock, and the saddle can be fed at rates from 0·004 to 0·04 in. per rev. The lead-screw for the saddle motions is located between the bed-ways, and the shaft which drives the cam for the relieving motion of the tool-slide is at the front of the machine.

At the end of each cutting traverse of the saddle, the tool is automatically held in the withdrawn position, and the 5-h.p. spindle-driving motor is reversed to return the saddle to the starting position for the next traverse. For this return motion, the motor runs at three times the forward speed. Before the next cut is taken, the tool is automatically fed forward by a hydraulically-operated mechanism at the front of the tool-slide, shown in the close-up view in Fig. 9. The amount of the feed can be adjusted in increments of 0·0016 in. by means of a knurled screw.

In addition to relieving hobs, the machine can be used for relieving cylindrical milling cutters, tapered cutters, and the teeth of end mills can also be relieved by adjusting the angular position of the relieving slide on the saddle. Form-relief grinding of the teeth of milling cutters and hobs can also be performed by means of an attachment which is fitted in place of the tool-slide. The spindle of this grinding attachment is driven by a flat belt from a motor carried on a swivelling bracket on a post at the rear of the cross-slide, which is brought forward to a position above the work.



VERTICAL BORING MILL

The type 1M 531 vertical turning and boring mill, shown in Fig. 10, is a product of the Krasnodar machine tool factory. On the 44-in. diameter table, workpieces up to 49 in. diameter, with

Fig. 10. Built in the Krasnodar machine tool factory, this vertical turning and boring mill has a capacity for work of up to 49 in. diameter by 39 in. high. There are 18 spindle speeds and 8 feed rates, also rapid traverse

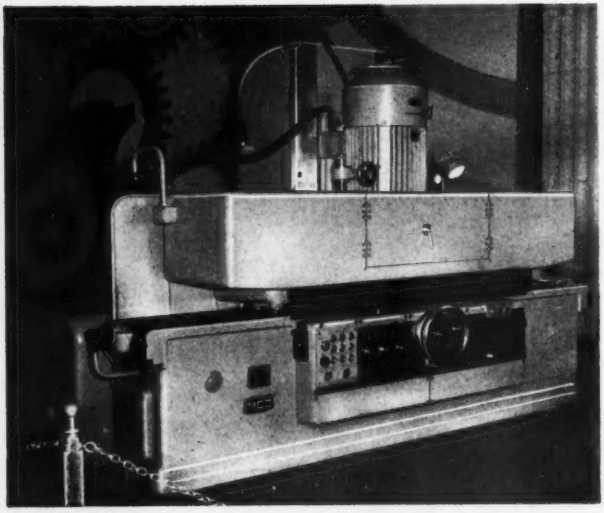


Fig. 11. A product of the Moscow grinding machine works, this type 3A 732 vertical-spindle surface grinding machine has a table measuring 12·6 by 31·5 in., and a capacity for workpieces up to 15·75 in. high

heights up to 39 in., and weighing up to about 2·5 tons can be accommodated. The table is driven by a motor of 37·5 h.p., through a gearbox which provides 18 speeds that range from 6·3 to 315 r.p.m.

Feed to each tool slide is provided by a separate motor of 1·3 h.p., and 8 feeds, ranging from 0·124 to 7 in. per min., are obtainable. The slides can also be rapid-traversed by separate motors at 7 ft. 6 in. per min., and the cross rail can be raised and lowered at 19·6 in. per min.

Horizontal and vertical movements of 33 and 27·6 in. are provided for the vertical slide and it can be swivelled through 45 deg. in each direction. For the horizontal slide, movements of 20·5 and 37·8 in. horizontally and vertically are obtained, and diameters up to 44 in. can be turned. The table is carried on precision adjustable roller bearings, and all driving shafts run in ball and roller bearings. Push buttons on the pendant panel at the left provide for the selection of all rapid traverse motions, starting and stopping of the main drive, disengagement of the feeds, and switching off the entire machine.

VERTICAL-SPINDLE SURFACE GRINDING MACHINE

Built at Moscow grinding machine works, the type 3A 732 vertical-spindle surface grinding machine, shown in Fig. 11, has a table measuring 12·6 by 31·5 in., and has a capacity for components up to 15·75 in. high. The table is reciprocated hydraulically at steplessly-variable rates from 10 to 98 ft. per min., during the automatic cycle, which provides for rough- and finish-grinding and sparking-out stages. At the rear of the table the wheel-head is supported on vertical guide-ways on which it can be rapid-traversed at 16 in. per min. A motor of 18 h.p. drives the wheel spindle directly, at a speed of 1,460 r.p.m., and a wheel of segmental form is fitted. The outer and inner diameters of the segments are 15·75 and 13 in., and they are 6 in. long.

For the automatic grinding cycle, the components are held on an electro-magnetic chuck supplied with the machine, or are clamped to the table. Feed rates of 0·0002 to 0·002 in. per table stroke are provided for rough-grinding, and the height of the ground surface is measured by an automatic control unit on the wheel slide. When a pre-set dimension has been reached, the feed rate is reduced to 0·0002 in. per stroke, and finally the feed is stopped while the sparking-out period is controlled by an automatic timer. After the expiry of the pre-set time, the wheel-head is automatically retracted and the machine is stopped.

CROMPTON HIGH-CAPACITY VEHICLE BATTERIES. A new range of high-capacity tubular batteries, particularly intended for use in fork-lift and industrial trucks, also electric road vehicles, has been developed by Crompton Parkinson, Ltd., Crompton House, Aldwych, London, W.C.2. The new batteries are stated to be complementary to the company's standard specially-armoured range, and to give an increase of 32 to 38 per cent in capacity for the same physical dimensions. Alternatively, for any given vehicle, the same capacity can be obtained with a battery that occupies less space than was formerly required, with the result that a larger load can be accommodated.

Other features of the new batteries include positive and negative plates of improved designs. The negative plates, of low-resistance microporous type, are armoured, and also serve as separators, so that the need for loose items is avoided.

Sidney G. Jones Demonstration

Sidney G. Jones, Ltd., 8 Balham Hill, London, S.W.12, recently staged a demonstration of some examples of the machine tools for which they are selling agents.

In Fig. 1 is shown an Endomatic type SC 2 machine, equipped with a new chain-type work conveyor, which has been specially built by Giddings & Lewis-Fraser, Ltd., Arbroath, for centring and facing 1¼-in. diameter by 6-in. long blanks in En. 361 steel. This machine, which was shown in operation, is generally similar to the standard type SC 2 (see MACHINERY, 93/596—10/9/58), except that both spindle heads can be adjusted towards and away from each other on the bed-ways, and the hydraulically-operated, self-centring, vice units for gripping the work are mounted vertically. Centre drilling and facing are carried out simultaneously on both ends of the work, and the operating cycle occupies about 30 sec.

The conveyor incorporates two endless chains fitted with channel-shaped cross plates, which have vee notches for locating the blanks. These chains are indexed, to bring the blanks, in turn, into line with the cutter spindles, by a hydraulically-operated plunger fitted with a pawl, which engages with one of the cross plates. During the indexing movement, the leading blank on the conveyor is located in an axial direction by the inclined edge of a deflector plate. The vice jaws are now closed to grip the blank, and, at the same time, raise it clear of the cross plates. Next, the spindles, which are driven at a speed of 825 r.p.m. by 5-h.p. motors, are advanced for drilling and facing the ends. When the spindles have been returned to their starting positions, the vice jaws are opened and the completed workpiece is lowered on the cross plates, and subsequently discharged towards the rear of the machine during the next indexing motion of the conveyor.

Made by Hans Lenze & Co., K.G., Hameln, Germany, the Gratomat machine shown in Fig. 2, which was available for demonstration, enables sprockets and external and internal gears and splined components to be de-burred on a fully-automatic cycle. External gears up to 19 in. diameter and internal gears up to 12 in. diameter, with pitches from 1·25 to 8 module, and a maximum face width of 14 in., can be handled on this machine.

The component to be de-burred is mounted on the 10-in. diameter work-table and positioned by means of a central locating piece, clamping being normally unnecessary. De-burring is carried out by a grinding unit of the portable electric type, which is mounted on an arm and can pivot in the vertical direction. The entire assembly can be swivelled on a cylindrical column attached to the base to bring the grinding wheel into position for operation on the teeth of gears of different diameters within the range handled by the machine. The grinding unit, which runs at a speed of 24,000 r.p.m., is over-balanced so that the grinding wheel is continuously held in contact with the teeth of the gear to be de-burred. During the working cycle, the table is continuously rotated, and since the wheel is maintained in contact with the teeth, a

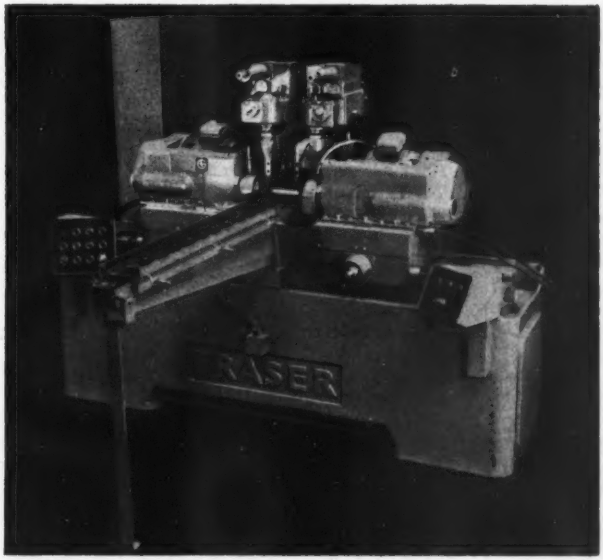


Fig. 1. Fitted with a new chain-type work conveyor, this Giddings & Lewis-Fraser Endomatic SC 2 machine is intended for facing and centring 1¼-in. diameter by 6-in. long steel blanks on a fully-automatic cycle

Fig. 2. Gratomat de-burring machine for gears, sprockets and splined parts

chamfer is ground at the roots, flanks and crests.

The amount by which the grinding head is over-balanced can be varied, and the working speed of the table can be adjusted steplessly from 0 to 2 r.p.m., to enable chamfers of different widths to be ground on the gear teeth. When the table has been turned through one complete revolution, a solenoid, which is connected to the nose end of the grinding unit by a cable, is energized, with the result that the grinding wheel is raised clear of the gear. At the same time, the work-table and the grinding unit are stopped.

A Rausch vertical broaching machine, made by the same company, has a pulling capacity of 3 tons, and can be supplied with working strokes of 23⅝, 39⅜, and 47¼ in., to take broaches with lengths of 46, 54, and 61 in. The broach slide is traversed by two screws driven by a pole-changing motor, which is fitted with a brake, and operating speeds of 78 in. per min. for the working stroke, and 156 in. per min. for the return travel are provided. A 12-station indexing work-holding attachment, equipment for surface broaching, and a carrier to take several broaches, can be supplied.

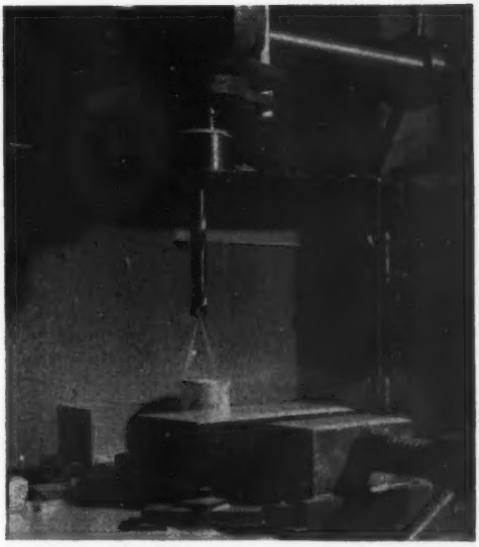
Other machines which were shown in operation, included a Monforts (German) type KA 200/150 chucking automatic; a Koepfer (German) type 150 universal gear hobbing machine; a type M 32 semi-automatic front turning lathe; and the type P/200 semi-automatic surface milling machine built by the Swiss firm of Ebosa.

"Cold Point" Twist Drills

Simms Motor & Electronics Corporation, Ltd., Oak Lane, East Finchley, London, N.2, have recently acquired a 50 per cent interest in the Bahamian firm of Cold Point, Ltd., who have obtained the manufacturing and selling rights, in all countries except the U.S.A. and Puerto Rico, for Cold Point twist drills of patented design. Developed in the U.S.A., Cold Point drills are being made in diameters from ¼ to ¾ in. by Horstman, Ltd., Bath, a member company of the Simms Group, and are distributed by Cold Point Drills, Ltd., Oak Lane, East Finchley, London, N.2—a wholly-owned subsidiary of Cold Point, Ltd.

The shank and flute portion of a Cold Point drill has a central bore, also a transverse end slot into which a tungsten carbide tip is secured by brazing. When drilling is in progress, coolant in the form of water-soluble oil, is delivered at a minimum pressure of 85 lb. per sq in., through the bore of the shank and flute portion, and an opening at each side of the tip, as may be seen in the accompanying figure, and is thus applied to the work directly at the point of cutting. The tip is cylindrical ground with a small amount of back taper, but no relief, and the diameter slightly exceeds that of the flutes, which, again, have no relief. A point angle of 120 deg. is usually ground on the drill, also a flat clearance angle, and negative rake, which has the effect of breaking up the cuttings into small pieces when drilling is in progress. With this design, drilling is carried out entirely by the tip, and the cuttings are discharged with the coolant along the flutes. Since coolant is applied at the point of cutting heating of the drill and the work is largely avoided. Because the cuttings are continuously flushed clear by the coolant, the risk of jamming and scoring of the hole is avoided, so that a good surface finish is obtained, and there is no need to withdraw the drill at intervals during operation.

Cold Point drills, it is claimed, offer particular advantages for drilling heat-resisting and high-



Cold Point tungsten-carbide tipped twist drills have negative cutting rake, and coolant is delivered under pressure through a central bore

strength alloys, also cast iron, low-alloy steels, and a variety of non-metallic materials such as Perspex, laminated plastics and glass. Except when drilling is being carried out on certain materials, the peripheral cutting speed should exceed 200 ft. per min., and for exceptionally hard metals, the feed should be of the order of 0·001 in. per rev.

During a series of tests which were carried out recently at the works of Simms Motor & Electronics Corporation, Ltd., a ⅜-in. diameter by 2-in. deep hole was drilled in a cast iron block by a Cold Point drill which was run at a speed of 2,500 r.p.m. to provide a cutting speed of the order of 400 ft. per min., with a feed of 0·002 in. per rev. Coolant was delivered through the bore of the drill at a pressure of about 100 lb. per sq. in. In another instance, a ¼-in. diameter hole was drilled in a billet of heat-resisting alloy developed in Germany and designated A.T.S.113. Feed was applied by hand, and a depth of 1½ in. was drilled in 57 sec. This alloy contains 22 per cent nickel, 22 per cent cobalt, and 20 per cent chromium, and as an indication of the difficulties that machining normally presents, it may be mentioned that when drilling was attempted with a conventional high-speed steel drill, the cutting edges became dulled when the drill had penetrated for a depth of less than $\frac{1}{16}$ in.

In another test, a ¼-in. diameter hole was drilled in a block of high-speed steel with a hardness of 65 Rockwell C. A spindle speed of 5,000 r.p.m. was employed and feed was applied by hand. For drilling a ⅜-in. diameter hole in Perspex, the drill spindle was run at 8,000 r.p.m., with hand feed. Coolant was delivered through the bore of the drill at 400 lb. per sq. in, pressure, and there was no "clouding" of the work material, which occurs when heating of the drill takes place.

National Physical Laboratory Open Days

The Open Days held recently at the National Physical Laboratory, Teddington, Middlesex, afforded visitors an opportunity of seeing something of the work that is being carried out by the various Divisions in the interests of science and industry.

The Standards Division receives sets of slip gauges from manufacturing companies in considerable numbers for calibration, and although the well-established optical interferometry technique usually employed for this work enables gauges to be measured to a very high degree of accuracy in terms of the fundamental standard of length, the procedure is necessarily slow. Much work has already been carried out in connection with the development of a comparator for automatically measuring slip gauges in sizes up to 1 in. to an accuracy of ±0·000001 in., using air gauging principles, and a prototype instrument was displayed. When this instrument has been completed, it is expected that it will be possible to check slip gauges in an 81-piece set, with the exception of the 2-, 3-, and 4-in. sizes in about 1 hour.

A slip gauge to be checked, and another of the same size which has already been calibrated, are mounted side by side in slots in a brass carrier. For fully automatic working, a number of carriers will be used, which will serve to present the slip gauges to the measuring head in order of reducing thickness. A magazine feed unit will be provided on the completed comparator for automatically delivering the carriers on to a loading platform at one side of the gauging head. While a comparison

is being made of the sizes of slip gauges mounted on one carrier, the next carrier is passed from the loading platform on to the end of a pair of guide rails, in readiness for checking, by two transfer arms, to which movement in the horizontal direction, also a rise and fall motion, is imparted by a motor-driven screw through a system of links.

When the gauging cycle has been completed, the first carrier is moved to the side of the gauging head remote from the loading platform, and, at the same time, the second carrier is brought to the checking position. Both slip gauges are now supported by a pair of rails which serve as an anvil, and the master gauge is positioned between the fixed lower nozzle and the adjustable upper nozzle of the air gauging system. Next, the upper nozzle is moved downwards under rapid power traverse by a motor and gear drive, and a screw, and the motor is stopped at a pre-determined point in its travel. Movement is then imparted to the nozzle by a servo motor, and continues until a pressure of 7 lb. per sq. in. has been built up in the air gauging system. The nozzle is then positioned at the pre-set height above the top face of the master gauge.

The equipment incorporates a bank of resistances which are selected to correspond to the known errors of the slip gauges of the master set. As the air gauging nozzle is set relative to the master of a pair of slip gauges in a carrier, the appropriate resistance is connected automatically to the electronic control system of the equipment, and a signal which corresponds to the known deviation of the master slip gauge from nominal size is fed to the indicator. As a result, the indicator is adjusted to compensate for this error. The carrier is next moved in the head to bring the slip gauge to be checked into the gauging position, and an indicator reading is then obtained which corresponds to the actual deviation of the thickness of the slip gauge from nominal size.

It should be emphasized that the equipment described is still in the course of development. When it is completed, facilities will be provided for automatically printing, on a paper strip, the thickness errors of both the master slip gauges and the gauges that are being checked.

ACCURATE MEASUREMENT OF SCREW FOR PITCH

Equipment shown in Fig. 1 enables master screws to be checked for pitch to an accuracy, it is claimed, within ±5 micro-inches. The design is based on development work carried out by the Division in this field, which was discussed in MACHINERY, 96/1171—25/5/60.

A screw to be checked is mounted in a V-block so that it is parallel with the top face of the base, and with a straight-edge secured to the base. The carriage is held in contact with the top face of the base and the straight-edge by means of two magnets, and carries a mirror which can swivel in the horizontal plane on upper and lower steel balls. A ball-ended stylus pin attached to the mirror is set at an angle of 45 deg., and engages with flanks of the thread groove to be measured. The carriage is set in different positions on the base with the aid of end standards, and the distance between one setting and the next corresponds to the nominal pitch of the screw which is being measured. The end standard is mounted on the carriage, and makes contact at one end with an anvil on the carrier piece for the mirror, and at the other, with a stylus pin connected to an electronic comparator (not shown in the illustration). Any change in the angular position of the mirror, when the carriage is moved from one position

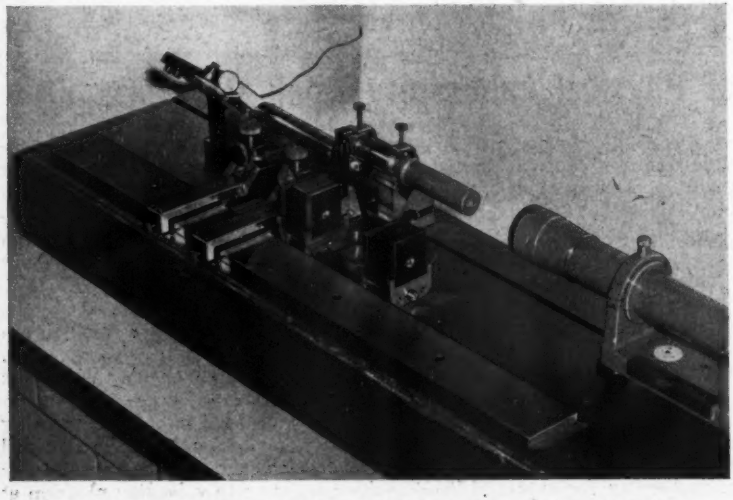


Fig. 1. Close-up view of equipment developed by the National Physical Laboratory for checking master screw threads for pitch

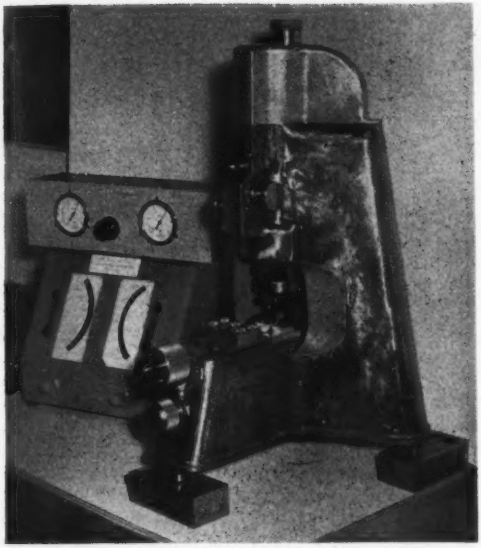


Fig. 2. This air gauging comparator is designed for checking plug gauges up to 3 in. diameter to an accuracy of ±0·000005 in.

to the next on the base, is measured by an autocollimator, and serves to indicate the pitch error between successive turns of the screw thread.

A PLUG GAUGE COMPARATOR

In Fig. 2 is shown a comparator, of the air-gauge type, on which development work is proceeding, for checking plug gauges up to 3 in. diameter to an accuracy of ±0·000005 in. A slip gauge and the plug gauge to be checked are mounted on the same slide, and stops are provided to prevent the plug gauge from rolling while checking is in progress. At the beginning of the checking operation, the slide is adjusted to bring the slip gauge between two hemispherical measuring pieces which are mounted at the ends of flexible metal strips attached to fixed parts of the instrument. Compressed air from a single supply is passed through separate nozzles, positioned close to the reverse sides of the metal strips, and the back pressures which are built up are applied to two Sigma Dialair indicator heads. These heads are mounted in a single frame and provide a magnification of 30,000×. The slide and its guideway member is hinged at the end nearest to the traversing handwheel, and at the other end, is attached to the body of the comparator by two flexible metal strips. These strips are moved towards or away from each other by means of a knob mounted below the handwheel, thus causing the slide assembly to be tilted slightly until an approximate zero reading is obtained on both indicator units. Final adjustment for zero is made by knobs on the Dialair units.

The slide is now traversed to bring the plug gauge to the measuring position, and the slide assembly is again tilted until a zero reading is obtained on one of the indicator units. The difference between the thickness of the slip gauge and the diameter of the plug gauge is then indicated by the reading on the other Dialair unit.

Trade Publications

NEWMAN INDUSTRIES, LTD., YATE, BRISTOL.—Specimen sheets indicating the procedure followed by the company for recording particulars of machining and fitting operations carried out in connection with machine tool rebuilding.

ALEXANDER S. NEWALL MACHINE TOOL CO., LTD., Microton House, 338 City Road, London, E.C.1. Folder covering the Schuler-Wolferal range of high-speed steel metal slitting saws with and without side chip clearance, also screw slotting cutters.

MIDLAND SILICONES, LTD., 68 Knightsbridge, London, S.W.1.—Folder concerned with the properties and applications of MS 4 silicone compound which may be used as a dielectric potting material, an auxiliary dielectric, a lubricant, a sealing material, a preservative, and a corrosion inhibitor.

ELECTRONIC INSTRUMENTS, LTD., Richmond, Surrey. Attractively-presented catalogue covering the company's extensive range of pH meters which includes the direct reading type 23A, the Vibron type 39A, the portable type 30B, the industrial types 28A and 38A, and the miniature type 28 AM. Separate sections are devoted to electrodes and electrode systems, accessories, and recording and control.

THE INCANDESCENT HEAT CO., LTD., Cornwall Road, Smethwick, Birmingham.—Reprint No. 507 describes concisely a process which has been developed by the Gas Atmospheres Division of the company for producing nitrogen/hydrogen mixtures from blast furnace gas. The resulting production, known as Hy-Nitrogen, is said to be finding increasing application for the heat treatment of steel strip and sheet.

ENFIELD ROLLING MILLS, LTD., Brimsdown, Enfield, Middlesex. Brochure of 17 pages concerned with the company's ERM resistance welding electrode materials. Following a list of products, there is a table giving typical physical properties and principal uses. Other sections are devoted, for example, to brazing instructions for ERM copper tungsten; choice of electrode materials; forms in which ERM alloys are produced; design of spot welding electrodes; standard electrodes, adapters and holders of various forms; and stock sizes of bar and seam welding wheels

Monks & Crane Machine Tool Exhibition

At an exhibition staged recently in the showroom of Monks & Crane, Ltd., Garretts Green Lane, Sheldon, Birmingham, 33, numerous machine tools were on view, of various types and makes, from the extensive range handled by the company, including bench, centre, tool-room and hydraulic copying lathes; cylindrical, vertical spindle surface, twist drill, and tool and cutter grinding machines; milling machines; bench and pillar drilling machines; hydraulic presses and croppers; sheet metal working machines; a Centemax machine; and a Marbaix disintegrator. Chucks, vices, and other accessories were also shown. In addition to British machine tools, there were exhibits from Sweden, Germany, and the U.S.A.

Among machines for which the company have recently been appointed distributors are the Swedish-built Rosenfors centre lathes, and a close-up view of one of these lathes is shown in Fig. 1. The lathes are available with centre heights of 8½ and 10½ in., which have corresponding swing capacities of 17¾ and 21½ in. over the beds, and 8 and 12 in. over the saddles. Separate vee and flat guideways are provided for the saddle and tailstock, and the width of the bed over the saddle guides is 16½ in. If required, lathes can be supplied with hardened steel guides.

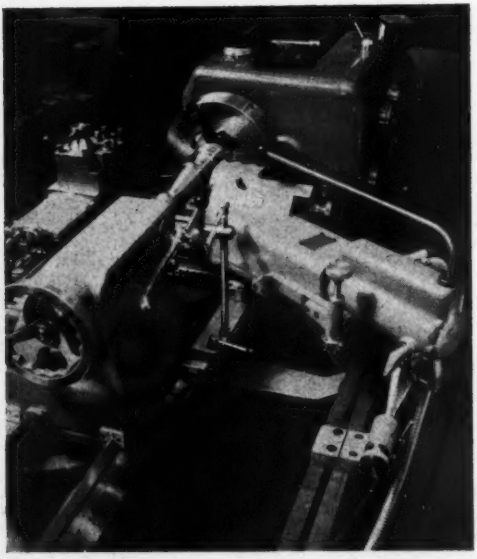


Fig. 1. Close-up view of the Rosenfors type RL-H lathe with copying attachment mounted at the rear of the cross-slide

Normally the drive is taken from a 15-h.p. motor, and the 24 spindle speeds then obtainable range from 15 to 1,500 r.p.m., in geometrical progression. Alternatively, a 20-h.p. motor can be provided and the speeds then range from 20 to 2,000 r.p.m. All shafts in the headstock run in anti-friction bearings, and the spindle, which normally has a type L-2 American standard nose, is mounted in three precision roller bearings. Forward and reverse drive are selected by means of multiple-disc clutches, and an electric multiple-disc brake provides for automatic stopping in the neutral position. On the lathe illustrated, the headstock is arranged for hydraulic speed changing, selection being made by means of a single dial. Alternatively, it can be supplied with a conventional lever change arrangement. A knob on the headstock provides for reversing the direction of feed for screw cutting and a second knob enables long leads to be cut at low speeds.

The feed box gives 45 rates from 0·004 to 0·12 in. per rev. for turning and from 0·002 to 0·06 in. per rev. for facing, and 72 in. pitches, from ¼ to 60 t.p.i., are obtainable without the use of change gears, including 27 "long" leads. Metric pitches range from 0·5 to 120 mm. By reversing the outer gear on the drive shaft, 33 module leads and 62 diametral pitches can be cut. For selection of longitudinal or cross feed there are toothed clutches in the apron. To facilitate batch machining operations, stops for disengaging the feed motions are provided as standard equipment. For the longitudinal motion there is an indexing stop bar which enables the feed to be tripped at any point within the full turning length and in either direction of movement.

Provision is made at the rear of the cross-slide for mounting an additional tool-post or a copy-turning attachment, as shown in Fig. 1.

The Rosenfors range also includes universal, plain, vertical, and production type milling machines with 51- by 12-in. tables, examples of which were exhibited. In Fig. 2 is shown the universal machine equipped with a motor-driven overarm attachment, which enables a wide range of operations to be performed. This machine has longitudinal, transverse, and vertical motions, by hand and power, of 28½, 10¾, and 16¾ in. respectively.

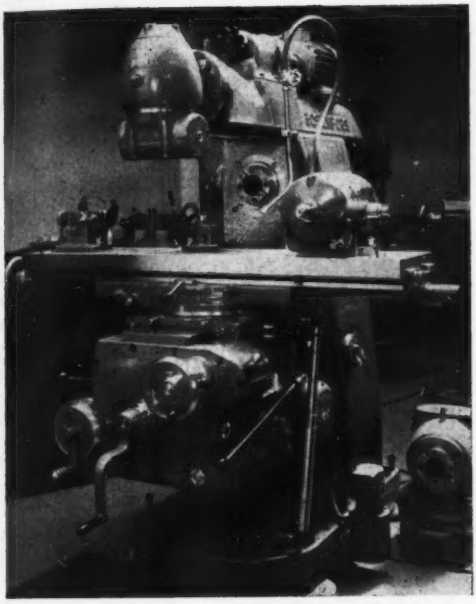


Fig. 2. Rosenfors type RFV universal milling machine equipped with a motor driven overarm cutter head attachment

Main drive is taken from a motor of 5-7·5 h.p. and there are 18 spindle speeds from 33 to 1,500 r.p.m. which are selected by means of a single crank lever at the left-hand side of the column. An electrical resistance brake provides for rapidly stopping the spindle, which is carried in double-row precision roller bearings, axial loads being taken by double-acting thrust ball bearings. Extra metal in the large gear on the spindle provides a flywheel action.

The feed gearbox and 1·5-h.p. driving motor are built into the knee. There is a choice of 16 feeds from ¾ to 38 in. per min. in the longitudinal and transverse directions, and from $\frac{5}{16}$ to 19 in. per min. in the vertical direction. Selection is made by means of a single crank lever at the front of the knee, and the setting is shown on a scale. The engagement levers for the various feed motions are directional. Rapid traverse is also available, at the rate of 125 in. per min. in the longitudinal and transverse directions, and 62 in. per min. vertically. An extra feed shaft, for a rotary table or other attachments, transmits drive to the right-hand end of the table.

Double feed nuts are provided for the longitudinal motion, one of which can be adjusted from the front of the saddle to take up backlash, and the machine can therefore be employed for climb milling.

Provision is made for swivelling the table and intermediate slide through 45 deg. in either direction. A maximum distance of 16¾ in. is obtainable between the centre of the spindle and the table surface and the distance from the column to the overarm brace is 23⅜ in.

The overarm attachment incorporates a 2-h.p. motor, and the eight spindle speeds available range from 125 to 1,500 r.p.m. It can be supplied with either a vertical or a universal milling head with a No. 40 spindle nose taper.

On the vertical milling machine in the Rosenfors range, a swivelling head of very robust design is provided, and on the production machine a variety of automatic table feed cycles can be obtained.

Another recent addition to the range handled by Monks & Crane, Ltd., is the transportable threading machine made by Smart & Brown (Machine Tools), Ltd., as described in MACHINERY, 97/99—13/7/60.

The company is now also distributing the Arboga range which comprises bench, pillar and radial drilling machines, small milling machines, and general-purpose tool grinders. A small bench drilling machine, known as the type E 210, is direct driven from a 2-speed motor of new design.

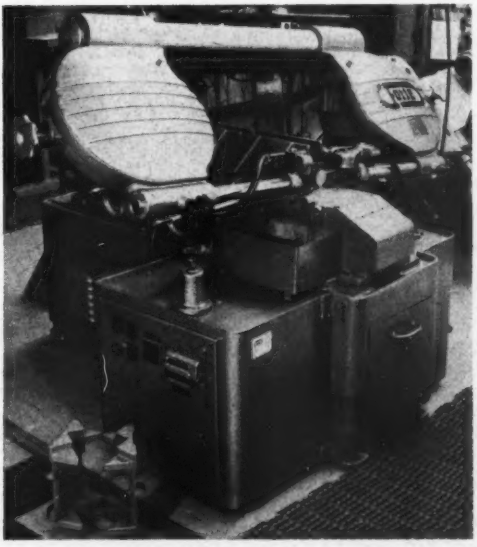


Fig. 3. The Fortemat BA.251 fully automatic metal bandsawing machine

It is claimed that this motor maintains a constant torque regardless of speed. Thus, when drilling larger holes within the capacity of the machine, the speed can be reduced to a suitable value by adjusting the feed pressure. A machine of this type is also now available with a Brottby Variator which enables the speed to be steplessly regulated by means of a single lever.

Arboga pillar drilling machines, of 1-in. capacity, can be supplied with built-in drill ejectors and with 4, 8, or 12 spindle speeds. If desired, the number of speeds on the latter machine can be increased to 14 by the addition of an auxiliary gearbox. Of generally similar design, the 1½-in. capacity pillar type machines have two rates of power feed.

There are five Arboga radial drilling machines, of which the largest, known as the E.R.830, has a capacity of 1½ in. diameter in steel at a maximum radius of 40 in. Another machine by this maker is the type E.M.825 vertical milling machine, which is driven by a 2-speed motor of 0·9/0·6 h.p., and enables drilling, milling, boring and reaming operations to be performed at any angle.

Forte horizontal bandsaws, which represent another addition to the machines handled by Monks & Crane, Ltd., include the type 250, with a capacity for cutting off round bars up to 10 in. diameter and rectangular sections up to 10¾ by 17¾ in. On the Fortemat BA. 251 machine shown in Fig. 3, which was demonstrated, provision is made for automatically advancing and re-clamping the bar after the completion of each cut. There is a scale for setting the length to be cut off, up to a maximum of 16 in., and an automatic counting device can be set to stop the machine when the required number of pieces has been cut. If required, the feed mechanism can be set to give a double stroke, and lengths up to 32 in. can then be cut.

Drive to the saw is taken from a motor of 1½ h.p. through a unit which gives steplessly variable speeds from 70 to 225 ft. per min. Provision is made for adjusting the load on the saw frame, which is raised at the end of the cycle by a hydraulic cylinder.

Finally, reference may be made to the range of chucks and power tool attachments by Supreme Products Corporation, U.S.A., for which Monks & Crane are now distributors. The chucks include geared key, keyless, tap and impact types, and chuck arbors and keys are also supplied. Among the attachments is the Versamate 7:1 speed reduction unit which can be applied to any portable power drill to enable screw driving, heavy duty drilling, hole sawing, and fly-cutting operations to be performed. Another unit, known as the Versamatic, also gives a 7:1 speed reduction and, in addition, provides fo reversing the drive. It may therefore be employed both for tightening and removing screws and nuts.

The "Push-Pull" tapper shown in Fig. 4, which is also included in the range, can be mounted either in a chuck or directly on the spindle of a portable drill. As in the case of the other attachments, the speed reduction is 7:1. When tapping is in progress the housing is held by the finger tips and any unusual strain can at once be felt. If the grip is released, the tap stops, and by pulling back, the drive is reversed to extract the tap. The attachment has a capacity for taps up to $\frac{5}{16}$-in. diameter, which are held in interchangeable collets.

Fig. 4. The Supreme "Push-Pull" tapper for use with portable drills gives speed reduction and reverse drive

Books Received

GENERAL DYNAMICS OF VIBRATIONS. By Y. Rocard, Crosby Lockwood & Son, Ltd., 26 Old Brompton Road, London, S.W.7. 522 pp. [Price 80s. 0d. net.]

There are many types of vibration—mechanical, acoustic, electro-magnetic, electrical—but the physical quantities involved are related by the same mathematical forms and are capable of the same mathematical treatment. This unification of outlook is effectively achieved in Professor Rochard's book, and the engineer-physicist is thus provided with a text that has long been needed.

From elementary conceptions of oscillatory systems, damping and impedance, the author proceeds to systems with several degrees of freedom, coupled systems, and electro-mechanical systems, also to shock excitation, filters, unstable systems and non-linear systems. A separate section is devoted to acoustic waves and their behaviour in horns, trumpets, loudspeakers and microphones.

NEWS OF THE INDUSTRY

Yorkshire

SIMILEX MANUFACTURING CO., LTD., Winton Works, Wharf Street, Sowerby Bridge, report that the demand for all sizes of T-nuts, hexagon headed bolts, and screws is continually increasing, and that there is a steady call for their swarf trucks and flat type warehouse trucks. The recently introduced swarf crushing machine, it is stated, has been very well received by industry, and a large number of enquiries has been received.

To meet the increasing request for various products, this company has recently acquired additional factory premises with a floor area of 1,650 sq. ft., and a Rushworth 4-ft. by ⅛-in. capacity over-crank guillotine shearing machine has been installed in these works.

HENRY BROADBENT, LTD., Hollins Tool Works, Sowerby Bridge, are experiencing a good demand for their standard 8½-in. and 10½-in. centre lathes. In addition, an increasing volume of orders and enquiries is being received for the company's larger machine tools, including turning and boring mills, centre lathes, and break lathes.

SWIFT-SUMMERSKILL, LTD., Sowerby Bridge, state that there has been a large increase in the volume of orders received in recent months for their standard spiral-drive double-column planing machines ranging up to 40-ft. stroke length, also for open-side type planing machines. Various sizes of planers of both types are at present in production in the works, including a machine with a stroke length of 30 ft. which is being provided with tandem tables. Mention may also be made of a planer equipped with a milling head of new design, with milling feeds for both the table and cross-slide traverses.

RUSHWORTH & CO. (SOWERBY BRIDGE), LTD., Clough Works, Sowerby Bridge, makers of sheet metal working machinery, including press brakes ranging up to 200 tons capacity, guillotine shearing machines, plate bending rolls, and punching and shearing machines, inform us that the volume of orders is maintained at a high level. Machines seen in progress included double-ended punching and shearing machines, over-crank type guillotine shearing machines, and plate bending rolls.

ORMEROD SHAPERS, LTD., Hebden Bridge, report that the recent increase in demand for their standard range of shaping and slotting machines has been sustained, and that there is a steady call for special machines. A 36-in. stroke shaping machine of the column and bed type, of special design, which was recently completed, has a vertical traverse of 3 ft. 5 in., and a horizontal traverse of 5 ft. 3 in.

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Four members of the staff of L. M. Van Moppes & Sons (Diamond Tools), Ltd., Basingstoke, Hants., who are participating in the British Trade Fair in Moscow, are here shown with a Morris Minibus which has been sent to Russia where it will be available for use by the company during the period of the Fair. Mr. N. R. Smith, works director of L. M. Van Moppes & Sons (Diamond Tools), Ltd., is on the right of the group. Other members of the company's exhibition staff travelled to Russia by air. The vehicle, carrying passengers and exhibits, went by sea from Tilbury to Leningrad, and was then driven to Moscow. Notices, in Russian, on the side of the vehicle indicate that it is being used in connection with the Fair

JOHN PICKLES & SONS (ENGINEERS), LTD., Hebden Bridge, makers of saw mill and woodworking machinery and equipment, are experiencing a heavy call for all the products in their range. Equipment recently completed for a large saw mill and woodworking plant for the Mersey Docks and Harbour Board included a planing and trying machine with a capacity for handling greenheart logs up to 27 in. square by 60 ft. long. This machine weighs approximately 40 tons.

Among machines seen in production in the works may be mentioned a rotary veneer peeler with a capacity of 54 in. diameter by 10 ft. 6 in. long, a number of 36-in. band sawing machines, spindle moulders, planers of both surface and the combined over/under types, tenoners, and a number of horizontal and vertical log frames. The foundry, which is busy in meeting requirements for the firm's products, is equipped for producing castings with weights up to 3½ tons.

We are informed that although there has been a slight falling off in the number of orders received from the export markets recently, the company is maintaining monthly exports representing approximately 50 per cent of production.

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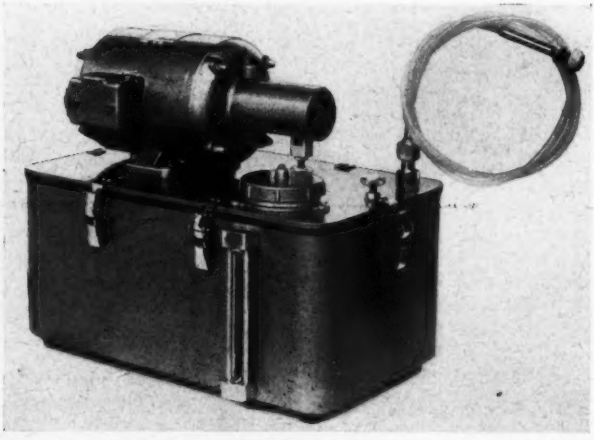
The Burgess-Duron motorized pump unit, here illustrated, has been introduced by Burgess Products Co., Ltd., Small Tools Division, Sapcote, Leics., in collaboration with J. C. Thompson & Co. (Duron), Ltd., Drummond Road, Bradford, primarily for the application, by airless spraying, of Duron anti-static emission to fibre slivers prior to spinning. By removing the spray nozzle, the unit can be used as a pump and will deliver liquids of various viscosities at pressures up to 150 lb. per sq. in. The container is of 2 gal. capacity, and the reciprocating type pump is driven by an eccentric on the shaft of the Brook ⅓-h.p. motor



A. KINGHORN & CO., LTD., Stackhills Road, Todmorden, are busy with the production of their full range of sheet metal working machinery, which includes press brakes, guillotine shearing machines, and special or modified machines to suit the individual requirements of various customers.

P. CROSSLEY, LTD., Cragg Road Works, Mytholmroyd, are busy with the production of hexagon-head screws, ranging up to ⅝ in. diameter by 3 in. long, with a wide variety of thread forms.

C. LINDLEY & CO., LTD., Beauvoir Works, Luddenden Foot (head office 34 Englefield Road, London, N.1), are experiencing an unparalleled demand for various types of bolts, screws, and nuts, including high-tensile bolts up to ⅝-in. maximum diameter. To enable the works to keep pace with the increasing call for these products, the company has embarked on an extension programme which provides for a large addition to the cold forming department.

Additional plant recently installed has included a cold heading machine with operating speeds up to 120 per min. and a semi-automatic cadmium and zinc plating plant, and new furnaces are shortly to be provided.

WHITELEY (RISHWORTH), LTD., Slitheroe Works, Rishworth, Nr. Halifax, inform us that they are busy with the manufacture of various products for the motor car industry. These products include water pumps, crown wheels and pinions, universal joints, tie-rod ends, king bolts, and shackle pins, and it may be noted that a thermostatically-controlled engine cooling fan has recently been developed, in which a number of motor car firms have shown interest.

BROOK MOTORS, LTD., Empress Works, Huddersfield, report that a number of orders has recently been received from the export markets. One of these orders, to the value of about £10,000, covering motors ranging from 5 to 250 h.p., is from Holland, and a Swedish firm has placed an order for 1,100 fractional horse-power flange-mounting motors, for use in oil burning appliances. A contract for the supply of 150 motors ranging from ½ to 40 h.p. for use on the Aswan High Dam project has been placed by the United Arab Republic,

and a customer in West Germany has ordered 1,000 dish-washing machine motors, which will be made in the new extension at the Barnsley factory.

SISKOL MACHINES, LTD., Siskol Works, Penistone Road, Sheffield, 6, report an increase in the volume of sales of the Siskol Precisor machine for accurate cutting of stone and concrete. The machine was shown for the first time at the recent Public Works Exhibition at Olympia and resulting enquiries and orders have indicated that there is a large potential export market.

R. SUTCLIFFE.

The Midlands

ALFRED HERBERT, LTD., Edgwick Works, Coventry, inform us that the demand for machine tools of many types continues and that the numerous orders received include many from overseas. Throughout the past year, the call for machines from the company's range has been such that delivery periods have inevitably lengthened, but it is anticipated that there will be an improvement in this respect when the additional productive capacity afforded by the acquisition of two engineering firms becomes fully effective. An increased volume of business is reported with the Common Market and E.F.T.A. countries, and with Japan. On the other hand, sales in the Indian market are being affected by import restrictions and payment difficulties.

At the Edgwick Works a new foundry is nearing completion and a light production shop, with a floor area of 40,000 sq. ft., is in the early stages of construction. A major project which is approaching completion is the company's applied research department wherein facilities will be afforded for conducting machine tool research on a wide scale.

New premises, including offices, a showroom, and warehouse, are shortly to be opened in Leeds in order to supplement the services provided by other branch establishments in the North. We may also note that offices and showrooms are to be built on a recently acquired site in Chiswick High Road, London, W.4.

B.S.A. TOOLS, LTD., Mackadown Lane, Kitts Green, Birmingham, 33, have recently completed an expansion scheme which has provided new combined office accommodation for the production engineering departments. Demand for the B.S.A. range of machine tools remains at a high level, both from home and foreign markets, and in the latter connection it may be noted that deliveries were made during 1960 to some 25 countries. The company is participating in the British Trade Fair which is now in progress in Moscow.

A B.S.A. No. 95 single-spindle automatic chucking machine with programme control utilizing a Discotrol unit, also a B.S.A. Acme-Gridley, ⅝-in., BRA 6-spindle bar automatic, are being demonstrated. Machine tools at present in production include B.S.A. Detroit broaching machines, multi- and single-spindle bar and chucking automatics, centreless grinders, copy turning lathes, and thread form generators.

PRECISION GEAR MACHINES & TOOLS, LTD., Bodmin Road, Coventry, have a good order book covering Red Ring gear shaving machines, GCU diagonal gear shaving machines and cutters, Briney boring heads, and re-circulating ball nuts and screws. During recent months several new machine tools have been installed in the works, including an Asquith OD4 radial drilling machine, a 4 B-72 De Vlieg Spiramatic Jigmil, and a Giddings & Lewis Fraser 35OT horizontal boring machine with a table designed to accommodate large workpieces.

ARTHUR SCRIVENER, LTD., 875 Tyburn Road, Birmingham, 24, are exceedingly busy with the production of their standard ranges of centreless and duplex surface grinding machines, also special purposes grinders for a variety of applications. The range of materials which are ground on Scrivener machines is extensive, and includes, in addition to metals in general use, glass, ceramics, synthetic resins and other plastics, and rubber. One interesting machine which has recently been built is intended for grinding cylindrical parts made from rubber. Normally, this material, by reason of its resilience, does not lend itself to close-limit centreless grinding. The Wickman-Scrivener machine has, however, been provided with carefully designed supporting fixtures for the work and satisfactory results are being obtained.

F. W. HERRIDGE.

Apprentice Training School

A new apprentice training school has recently been opened at the Queens Island works of Harland & Wolff, Ltd., Belfast, and a general view of the spacious and well-equipped workshop is given in Fig. 1. The shop is divided longitudinally by the centre row of roof supports, to form two sections of approximately equal area, and the section to the right, as viewed in the figure, is devoted to engineering training of the type required for those apprentices who are to enter the engine works.

A comprehensive selection of machine tools of a variety of types has been provided in this area, and the benches at the centre are used for training in

hand-finishing techniques. In the right foreground can be seen a small diesel engine, which is used for assembly and stripping training, and was built by the apprentices.

The area to the left of the dividing line is devoted to shipyard trades, and provides training for those apprentices who intend to enter the yards. To assist in a full understanding of the structural and plating aspects of shipbuilding, the apprentices build large-scale models, similar to that shown in Fig. 2. This model is true both as regards scale and method of construction, and is built up to the approximate stage at which the ship would be launched. The shipbuilding area of the school also incorporates a section devoted to electrical engineering, and there are various large switchboards, of the types installed in ships, which can be built up and dismantled by the apprentices.

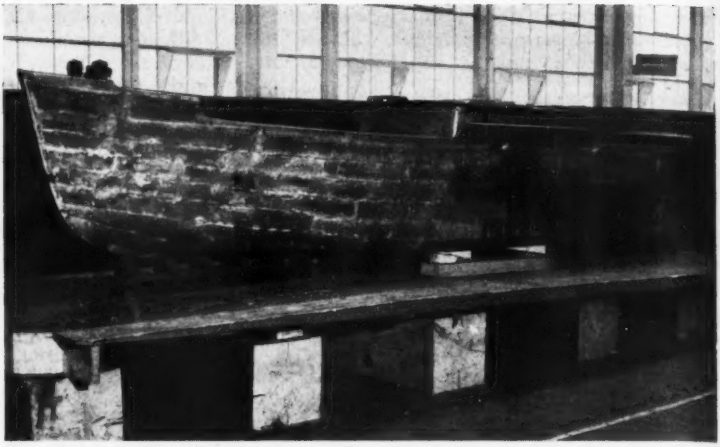


Fig. 2. This model ship is true both as regards scale and method of construction, and is being built by the apprentices in the shipyard section of the school

At the far end of the building, as viewed in Fig. 1, there are class rooms, a large lecture room with facilities for film projection, an inspection department, and accommodation for the lecturing staff. The latter comprises the Principal of the school, six instructors, and a chief inspector. It is stated that there is an average of 100 indentured apprentices in training in the school.

Fig. 1. General view of the new apprentice training school which has recently been opened at the Queens Island works of Harland & Wolff, Ltd., Belfast. On the average, 100 indentured apprentices are in training for the shipyards and the engine works

Investment Casters

The third annual conference of the British Investment Casters' Technical Association, which was held in London recently, was well attended by members and guests from this country and overseas. Titles of papers relating

to metals, which were presented, included "Tensile, Ductility and Stress Rupture Properties of Investment Cast Nimocast 90 Alloy," in two parts, and "Recent Developments in Alloys for Aircraft Gas Turbine Rotor Blading." Materials for patterns and moulds were discussed under the headings "Polystyrene, a Material for Patterns," and "Ethyl Silicate and Colloidal Silica as Bonding Agents for Ceramic Shell Moulds." Business methods were considered in a paper on "Dynamic Accountancy," and another paper was devoted to "The Control of Product Quality." Two American exchange papers were concerned with "Specifying Reliability" and "Potential Health Hazards in the Investment Casting Industry."

At the dinner which followed the conference, the toast to "The Association" was proposed by Sir Miles Thomas, D.F.C., M.I.Mech.E., and Mr. R. W. N. Danielson, M.B.E., T.D., chairman of the Association, responded. In reply to the toast of "The Guests", proposed by Mr. W. Foyers, A.M.I.Prod.E., vice-chairman of the Association, Mr. Frank Nixon, B.Sc. (Hons. Eng.), M.I.Mech.E., F.R.Ac.S., M.I.Prod.E., chief quality engineer, Aero Engine Division, Rolls Royce, Ltd., Derby, spoke of the need for breaking down the customer's inborn mistrust of castings, and overcoming the lack of knowledge of the applications of castings by engineers and the reluctance of designers to investigate new fields, if the investment casting industry was to continue to progress.

New Companies Registered*

CHALMERS PRECISION ENGINEERING, LTD., Humber Works, Humber Road, Beeston, Notts. Registered April 24, 1961. Nom. cap.: £10,000 in £1 shares. Permanent directors: J. B. Cleland, A. Chalmers, and A. Frame.

JAMESBURY-SERCK LTD., Eastern Avenue, Gloucester. Registered April 25, 1961. To carry on the business of designers and manufacturers of valves, fittings, plant, etc. Nom. cap.: £101,000 in £1 shares. Directors: to be appointed by subscribers. Subscribers: B. Callett, 88 Lea View House, Springfield, London, E.5, and P. E. Edwards, 87 Brian Avenue, Sanderstead, Surrey.

CONVEYANCER-RAYMOND, LTD., Liverpool Road, Warrington, Lancs. Registered May 1, 1961. To carry on the business of manufacturers of trucks and other material handling equipment, and to sell and distribute such trucks and equipment in the United Kingdom and elsewhere; to enter into an agreement with Raymond Corporation of Green, New York, U.S.A., which is referred to in paragraph 20 of Heads of Agreement between Conveyancer Ford Trucks, Ltd., of Liverpool Road, Warrington; and the said Raymond Corporation. Nom. cap.: £50,000 in £1 shares. Directors: A. G. Beech Owen, C. W. Sharp, G. R. Raymond and L. Rumley.

*From the lists compiled by Jordan & Sons, Ltd., Company Registration Agents, 116-118 Chancery Lane, London, W.C.2.

Machine Tool Exports and Imports

EXPORTS OF MACHINE TOOLS

Type of Machine	Month ended March 31, 1961	Three months ended March 31	
		1960	1961
	Value £	Value £	Value £
New, complete:—			
Bar and chucking automatics	166,095	236,301	330,704
Boring machines:			
Vertical	133,003	108,025	409,036
Other	94,077	425,458	278,504
Drilling machines	147,623	388,058	437,997
Gear-cutting machines	108,427	354,387	266,364
Grinding, lapping and honing machines	299,135	610,183	924,932
Lathes:			
Capstan and turret	292,548	510,439	824,048
Other	347,604	950,508	1,005,357
Milling machines	281,540	543,433	740,334
Planing machines	31,417	75,151	114,873
Presses:			
Hydraulic	164,344	505,128	267,814
Other	120,823	434,249	385,497
Punching and shearing machines	87,452	130,915	242,175
Other plate and sheet metal working machines, including straightening rolls	87,904	220,296	215,560
Screwing and threading machines	39,489	214,151	257,227
Shaping and slotting machines	64,199	100,525	155,284
All other machines	236,661	708,038	995,485
Used, complete	115,470	218,131	198,523
Parts	377,868	724,829	1,199,190
Total	3,195,679	7,458,205	9,248,904
Destination			
Union of South Africa	171,664	267,532	439,808
India	331,992	782,000	1,346,372
Australia	522,008	1,763,851	1,422,387
New Zealand	88,716	86,723	246,007
Canada	197,470	352,137	455,132
Other Commonwealth countries	161 635	392,751	523,091
Soviet Union	79,244	154,802	245,934
Sweden	136,966	152,572	303,261
Western Germany	204,449	197,382	480,474
Netherlands	61,830	115,580	218,548
France	112,662	518,261	381,836
Spain	132,108	142,262	251,435
Italy	195,669	145,900	537,570
United States of America	97,864	701,101	348,786
Other foreign countries	701,402	1,685,351	2,048,263

IMPORTS OF MACHINE TOOLS

New, complete:—			
Bar and chucking automatics	83,421	154,071	237,577
Boring machines	137,288	402,381	268,396
Drilling machines	44,727	56,569	102,404
Gear-cutting machines	191,896	41,915	816,075
Grinding, lapping and honing machines	425,834	725,484	1,276,039
Lathes	386,008	425,264	945,970
Milling machines	263,927	764,558	758,994
Planing, shaping and slotting machines	75,749	69,384	170,421
Presses	217,931	280,769	464,426
All other machines	430,096	790,778	1,267,298
Used machines, complete	78,895	309,996	224,337
Parts	314,544	712,283	905,125
Total	2,670,316	4,733,452	7,437,062
Country of Origin			
Western Germany	809,229	1,384,477	2,100,214
Switzerland	255,107	665,003	823,479
U.S. America	1,073,141	1,649,195	3,110,193
Other countries	532,839	1,034,777	1,403,176

Industrial Notes

HUNSLET (HOLDINGS), LTD., Hunslet Engine Works, Leeds, 10, have acquired the whole of the share capital of Materials Handling Equipment (Great Britain), Ltd., of Maidenhead and London.

HILGER & WATTS, LTD., 98 St. Pancras Way, Camden Road, London, N.W.1, inform us that Wray (Optical Works), Ltd. are now associated with them. Mr. A. W. Smith (a former president of S.I.M.A.) will continue as managing director of the latter company.

AYRSHIRE METAL PRODUCTS, LTD., is the new name of the company formerly known as the Ayrshire Dockyard Co., Ltd., Irvine, Ayrshire, where, since 1938, ship repairing work has given way to the production of cold-formed sections, metal partitions, and other metal products.

THE NUMBER OF PEOPLE EMPLOYED IN MANUFACTURING INDUSTRIES fell in March by 9,000 in all. There was a rise of 3,000 in "engineering and electrical goods," a fall of 5,000 in "shipbuilding and marine engineering," a fall of 1,000 in "vehicles," and a fall of 1,000 in "metal goods." For "metal manufacture" the number was unchanged.

MERCANTILE LEASING CO., LTD., 7-8 Saville Row, London, W.1, have introduced a leasing scheme which enables companies to employ new machinery, equipment, and vehicles, without demands on working capital. Full particulars of the plan can be obtained from the above address.

LANSING BAGNALL, LTD., Basingstoke, Hants.—A new depot and service centre for materials handling trucks and tractors was recently opened by this company in Cardiff. It replaces a previous depot in the city and forms the headquarters of the Welsh region. Other depots are to be opened shortly in Bristol and Portsmouth.

STEEL AND PIG-IRON PRODUCTION.—Steel production in April, which was affected by the Easter holiday, averaged 471,600 tons per week, as compared with 471,000 tons in March, and 478,100 tons in April, 1960. For pig-iron, the corresponding figures were 308,400 tons, 313,500 tons, and 310,600 tons.

HARDY SPICER, LTD., Chester Road, Erdington, Birmingham, 24, a member company of the Birfield Group, have received an order from the Lancia Motor Co. of Turin, to supply Birfield constant velocity universal joints to the value of £300,000 a year. Intended for use on front wheel drive cars, these joints are being fitted to the Lancia Flavia.

P.M.T. (MACHINE TOOLS), LTD., Oozells Street, Birmingham, 1, have been appointed sole selling agents for the Mullard Autoplot and automatic co-ordinate positioning machines designed for automatic marking out on sheet metal and similar work, under electronic numerical control. A demonstration machine is available at the company's Birmingham showrooms.

JAMES H. RANDALL & SON, LTD., Paddington Green Works, London, W.2, have recently extended their range of Raaco industrial cabinets, for the storage of small items, by the addition of a 14-drawer unit with overall dimensions of 7¾ by 12¼ by 5¾ in. deep. The transparent toughened plastics drawers have adjustable sub-dividers, which enable a maximum of 54 separate compartments to be obtained.

SCHOOL OF WELDING TECHNOLOGY, 54 Princes Gate, London, S.W.7. A prospectus is now available giving particulars of courses to be held in October on: welded pressure vessels, residual stresses and stress relief, and practical control of distortion. A provisional programme for the period November 1961 to March 1962 is also included.

HONEYWELL CONTROLS, LTD., Greenford, Middlesex, have received an order from the Continuous Casting Co., Ltd., for the complete instrumentation of a twin-strand continuous casting machine to be installed at the Abbey Works of the Steel Company of Wales. The machine will be provided with a new integrated 2-wire electric system known as the ElectriK Tel-O-Set.

TRANSLATIONS OF GERMAN INDUSTRIAL STANDARDS.—The German Standards Committee (Deutscher Normenausschuss), Berlin, W.15, has established a special department to prepare translations of German industrial standards into English. So far, 1,200 English translations have been made. Lists of the translations available may be obtained, free of charge, from Beuth-Vertrieb, G.m.b.H., 175 Uhlandstrasse, Berlin, W.15.

MEASURING AND IMPROVING PURCHASING PERFORMANCE will be the subject of 2-day seminars which will be conducted by Mr. Paul V. Farrell. They will be held as follows: in Manchester on June 15 and 16; in Birmingham on June 19 and 20; and in London on June 22 and 23. Full particulars may be obtained from Materials Management International, Ltd., 66 Chandos Place, Strand, London, W.C.2.

JOHN BAKER & SONS, LTD., Malinda Street, Sheffield, 3, makers of Lighthouse engineers' files, inform us that over the past twelve months they have been making special efforts further to improve the quality of their products. As a result they have been successful in obtaining a pilot order from a Swedish company, on the basis of quality alone, despite the recognized high standard of Swedish-made files.

DISTRIBUTOR REQUIRED FOR SWEDISH MOTORS.—A member of the British-Swedish Chamber of Commerce in Sweden, Hovslagargatan 5B, Stockholm C, wishes to appoint a sole distributor for the United Kingdom, to stock, distribute, and service special D.C. motors for mechanical handling, fork trucks, and various light marine, industrial and transport applications. Full particulars can be obtained from the above address (Ref.: D.2-10/AEW/AvB).

EXPORT CREDITS GUARANTEE DEPARTMENT, 59-67 Gresham Street, London, E.C.2, have announced that business insured in the financial year ended March 31, last, was again a record at £742·5 million (provisional), as compared with £694·5 million in the previous year. Of these totals, "commercial business" accounted for £720·8 million (provisional) and £671·1 million, respectively. In 1955-56 the corresponding figure was £394·6 million.

INTERNATIONAL COMPUTERS AND TABULATORS, LTD., have taken over the premises of Glover & Main, Ltd., Thornton Road, Croydon, thereby adding 100,000 sq. ft. of manufacturing space to the 290,000 sq. ft. already available at the I.C.T. Croydon factory. The new facilities will provide initially for the assembly of I.C.T. 900 series tabulators.

THE BRITISH ELECTRICAL AND ALLIED MANUFACTURERS' ASSOCIATION (INC.), 36 Kingsway, London, W.C.2, have established an Industrial Electronic Equipment Section and a Nuclear Reactor Section. The former will undertake routine work in connection with technical matters, standardization, exports, and statistics, and will also provide for closer discussions with other associations, and wider examination of general policy questions affecting the industrial electronics industry as a whole.

ADDRESSOGRAPH-MULTIGRAPH, LTD., have installed at their Hemel Hempstead factory the Mark 4 Auto-Thermatic fire detection system developed by Sound Diffusion (Autothermatic), Ltd., Portslade, Sussex. Five areas in the factory are represented on a central control cabinet by indicator lamps which are illuminated immediately a detector link in the circuit becomes fused by heat. All works alarms are sounded to summon the fire-fighting team, and simultaneously the fire brigade, about one mile away, is automatically called. In the factory, there is a built-in circuit to take a plug-in hand telephone set at selected points.

LONDEX, LTD., 207 Anerley Road, London, S.E.20.—To mark the 25th anniversary of the founding of the company, a data book on Londex relays and electrical automatic control apparatus has been produced, which contains 52 pages of useful information on various types of relays, process timers, photo-electric equipment, counters, fluid and gas controls, Buxton-certified flame-proof controls, various miscellaneous controls, indicator units and alarm circuit systems, and beacons.

The company's employees now number more than 400, and of the range of products, it is stated that more than 2,000,000 electro-magnetic relays alone have been manufactured during the past 25 years.

S.I.M.A. Interfirm Comparison

The report of the first interfirm comparison among members of the Scientific Instrument Manufacturers' Association of Great Britain, 20 Queen Anne Street, London, W.1, has been issued to the 24 firms taking part. Each management now knows how its overall success compares with that of others, and the main causes of differences.

This comparison was conducted for S.I.M.A. by the Centre for Interfirm Comparison, which is a neutral expert organization set up by the British Institute of Management and the British Productivity Council to undertake such work on behalf of any group of firms or trade association.

Certain key ratios were calculated for each firm from information supplied by them confidentially. The ratios were carefully selected to show the managements of participating firms how their returns on capital employed compared with those of others, and in what parts of their businesses there might be weaknesses responsible for differences in such returns.

MACHINERY'S ENQUIRY BUREAU

For many years MACHINERY has provided an enquiry service not only for subscribers and advertisers but for all engineers in need of such information as the names of makers—or their agents—of machines or equipment for performing particular operations, suppliers of various classes of material, firms with facilities for undertaking certain types of work, owners of trade names, and agents for foreign machine builders. If you have such a problem write (MACHINERY, Enquiry Bureau, Clifton House, 83-117 Euston Road, London, N.W.1) or telephone (Euston 8441, 2 lines). This service is, of course, entirely free.

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British Trade Fair, Stockholm

For the purpose of expanding British exports to Sweden, and to ensure that advantage is taken of the tariff reductions afforded by the mutual membership of the E.F.T.A., a British Trade Fair is to be held at St. Erik's Fairgrounds, Stockholm, from May 18 to June 3, 1962, under the joint sponsorship of the Federation of British Industries and the Export Council for Europe. It is being organized by British Overseas Fairs, Ltd., 21 Tothill Street, London, S.W.1, with the full support of both the British and Swedish Governments, and it is intended that the exhibits should cover the wide range of items imported by the country, which includes capital equipment, industrial components, raw and semi-finished materials, and consumer goods.

Special provision, it is stated, is to be made for exhibition space to be occupied by trade groups, to permit the participation of small companies.

Speaking recently at a meeting held at the Swedish Embassy, London, Sir Norman Kipping, director-general of the F.B.I., gave some details of the arrangements which are to be made, and stated that in readiness for the Fair, the main hall is being extended, and with two pavilions, will provide a total indoor exhibition area of 100,000 sq. ft. In addition, there will be an outdoor area of 175,000 sq. ft.

Personal

MR. BRIAN WADE, a section charge hand at the Harmondsworth factory of Black & Decker, Ltd., was recently presented with a cheque for £200 by Mr. Robert Appleby, the managing director. The award—the largest yet given in connection with a production costs savings scheme—was made for a design for a driver for armature shafts which eliminates the use of carriers.

The following new appointments have been announced:—

SIR ARTHUR VERE HARVEY, C.B.E., M.P., managing director of CIBA United Kingdom, Ltd., to the Board of CIBA, Ltd., Basle.

MR. F. E. COLLIS as production director (designate) of the Perkins Group at Peterborough. He will take up his duties on June 1.

MR. R. C. SHUSTER, M.I.Prod.E., formerly works manager of E. H. Bentall & Co., Ltd., Maldon, Essex, as works manager of Christy & Norris, Ltd., Chelmsford.

MR. R. S. GILLING, B.Sc., A.M.I.E.E., A.M.I.W.M., as manager of the Associated Electrical Industries, Ltd., Military and Marine Radar Works, at Blackbird Road, Leicester, which forms part of the Electronic Apparatus Division.

MR. E. W. HERRINGTON, M.I.Mech.E., M.I.H.V.E., formerly with the Ministry of Works Engineering Division, as engineer in charge of the Mechanical and Electrical Service Department of the Industrial Division of E. G. Irwin & Partners, Ltd., 2 Princes Row, London, S.W.1.

MR. J. A. MILLS, previously works manager and chief engineer, as director and general manager, Mr. K. V. THOMASON, previously production manager for North British Locomotive Co., Ltd., as works manager, and MR. W. LYON, formerly chief methods engineer for North British Locomotive Co., Ltd., as production engineer of Churchill Gear Machines, Ltd., Blaydon, Co. Durham.

MR. J. H. RAYNOR, formerly with Stuart Davis, Ltd., and MR. J. R. THOMPSON, formerly with The Churchill Machine Tool Co., Ltd., as machine tool sales engineers for Rockwell Machine Tool Co., Ltd., Welsh Harp, Edgware Road, London, N.W.2. They will operate in the Midlands area from the Birmingham office of the company.

Obituary

MR. H. G. MANSELL, managing director of Coventry Precision, Ltd., Coventry, died suddenly on May 12.

Scrap Metals

†LONDON.—‡Prices per ton for non-ferrous scrap metals free from iron are as follows:—Clean copper wire, untinned and free from lead and solder, £209; clean heavy copper, untinned and free from lead and solder, £205; copper wire No. 2, £198; clean light copper, £195; braziery copper, £178; gunmetal, £184; brass, mixed, £136; lead, net, £55; zinc, £45; cast aluminium, £100; old rolled aluminium, £103; battery lead, £28; unsweated brass radiators, £105; hollow pewter, £550; black pewter, £430.

MIDLANDS.—Prices for copper scrap have strengthened further during the past week and it appears that the surplus of supplies, which was apparent about two months ago, is gradually being absorbed by a brisk market and that the improvement will continue. Merchants are tending to move material more quickly to take advantage of higher prices which buyers are able to offer.

Tin has also shown another strong advance in value, and due to shortage of supplies there is a possibility of even better prices in the near future, unless any stocks held in reserve are released to the market.

Trading, in general, is very active.

Copper.—Prices for No. 2 wire and braziery material have increased by approximately £3 per ton, and for better grades, including heavy and No. 1 wire, by about £5 per ton.

Brass.—An additional £2 to £3 per ton is obtainable from most buyers for all grades.

Gunmetal.—There are ready outlets for all qualities and prices have improved by at least £3 per ton.

Lead.—The market is featureless. Slight recent gains have been reversed and in the last few days there has been a fall of about £1 per ton.

Aluminium.—Steady trading has been maintained although there has been no improvement in outlook. Users' stocks appear to be sufficient to meet demands for finished products, and until this balance is altered an improvement in prices cannot be foreseen.

Zinc.—Prices for most grades have eased by approximately £2 per ton.

† George Cohen, Sons & Co., Ltd., 600 Wood Lane, London, W.12.
‡ Subject to market fluctuations.

Machine Tool Share Market

A high level of activity was maintained in stock markets during the period under review, with interest centred mainly in industrial equities, and although there was some irregularity in price movements, the general undertone remained firm.

British Funds and similar gilt-edged stocks met with steady investment support which led to an improvement in values.

Buoyant conditions prevailed in the commercial and industrial share sections where the general trend was upwards. Towards the close, however, a slightly easier tendency developed owing to profit taking and a slackening of demand, and final prices were below the best.

Among machine tool issues, Arnott & Harrison advanced 1s. 6d. to 16s.; British Oxygen, 1s. to 27s.; Brooke Tool, 1½d. to 10s. 4½d.; Clarkson (Engineers), 6s. 3d. to 45s.; Coventry Gauge & Tool, 6d. to 32s. 10½d.; Craven Bros. (Manchester), 3d. to 11s. 9d.; John Harper, 1½d. to 8s. 4½d.; Alfred Herbert, 1s. to 78s. 6d.; H. W. Kearns, 9d. to 25s.; Samuel Osborn, 3d. to 58s. 6d.; F. Pratt, 1s. 9d. to 18s. 9d.; Sanderson Kayser, 1s. 3d. to 40s.; Ambrose Shardlow, 2s. 6d. to 70s.; Scottish Machine Tool, 1s. to 12s. 3d.; Sheffield Twist Drill, 3d. to 19s. 9d.; and Thos. W. Ward, 2s. to 83s.

On the other hand, Edgar Allen lost 3d. at 46s. 3d.; Chas. Churchill, 1½d. at 10s.; and Macready's Metal, 9d. at 17s. 3d.

F. PRATT & CO., LTD. Interim div. 6 per cent (same).

Film on Stone-Vapor Boilers

"Space Age Steam" is the title of a new film which was recently shown in London by J. Stone & Co. (Deptford), Ltd., Arklow Road, London, S.E.14, to draw attention to the features and advantages of Stone-Vapor steam boilers.

Of the forced-circulation, water-tube type, these boilers, which are made under licence from the Vapor Heating Corporation, Chicago, U.S.A., enable steam to be raised within 2 min. of starting, and are available in four standard sizes with steam evaporation rates up to 5,420 lb. per hour and pressures up to 300 lb. per sq. in. Multiple units with outputs up to 30,000 lb. per hour can also be supplied.

In the Stone-Vapor boiler, heating of the water coils is effected by the combustion of fuel oil which is ignited by a continuous electric spark discharge. Alternatively, provision can be made for gas heating. Drive to the water pump, the fuel pump, and the forced draught fan is taken from a single electric motor through V-belts and pulleys.

The film is obtainable free on loan in the 16-mm. size. It is in colour and runs for about 40 min.

COMPANY		Denom.	Middle Price
Abwood Machine Tools, Ltd.	Ord.	1/-	2/-
Allen (Edgar) & Co., Ltd.	Ord.	£1	46/3
" " "	5% Prf.	£1	13/9*
Arnott & Harrison, Ltd.	Ord.	4/-	16/-
Asquith Machine Tool Corp., Ltd.	Ord.	5/-	12/6
" " "	6% Cum. Prf.	£1	16/6
Birmingham Small Arms Co., Ltd.	Ord.	10/-	34/6
" " "	5% Cum. "A" Prf.	£1	14/6
" " "	6% Cum. "B" Prf.	£1	17/-
" "	4% 1st Mort. Deb.	Stk.	92
British Oxygen Co., Ltd.	Ord.	5/-	27/- ex Capn.
" " "	6% Cum. Prf.	£1	20/6xd
Brooke Tool Manufacturing Co., Ltd.	Ord.	5/-	10/4½
Broom & Wade, Ltd.	Ord.	5/-	28/3
" "	6% Cum. Prf.	£1	16/6
Brown (David) Corporation, Ltd.	5½% Cum. Prf.	£1	16/-
Buck & Hickman, Ltd.	6% Cum. Prf.	£1	17/-
Butler Machine Tool Co., Ltd.	Ord.	5/-	16/3
" " "	5% Cum. Prf.	£1	14/3
Churchill (Charles) & Co., Ltd.	Ord.	2/-	10/-
" " "	6% Cum. Prf.	£1	25/4½‡
Clarkson (Engrs.), Ltd.	Ord.	5/-	45/-
Cohen (George), 600 Group, Ltd.	Ord.	5/-	14/6
" " "	4½% Cum. Prf.	£1	12/6
Coventry Gauge & Tool Co., Ltd.	Ord.	10/-	32/10½
" " "	5% Cum. Red. Prf.	£1	16/3
Craven Bros. (Manchester), Ltd.	Ord.	5/-	11/9
Elliott (B.) & Co., Ltd.	Ord.	1/-	3/7½
" "	4½% Red. Cum. Prf.	£1	12/-
Expert Tool & Case Hardening Co., Ltd.	Ord.	2/-	2/7½
Firth Brown Tools, Ltd.	4% Cum. Prf.	£1	11/-
Greenwood & Batley, Ltd.	Ord.	10/-	28/-
Harper (John) & Co., Ltd.	Ord.	5/-	8/4½
" " "	4½% Red. Cum. Prf.	£1	12/-
Herbert (Alfred), Ltd.	Ord.	£1	78/6
Holroyd (John) & Co., Ltd.	"A" Ord.	5/-	22/6
" "	"B" Ord.	5/-	20/6
Jones (A. A.) & Shipman, Ltd.	Ord.	5/-	28/6 ex Capn.
" " "	7% Cum. Prf.	5/-	4/9
Kearney & Trecker-C.V.A., Ltd.	5½% Red. Cum. Prf.	£1	11/-
" " "	Prefd. Ord.	£1	13/9
Kearns (H. W.) & Co., Ltd.	Ord.	5/-	25/-
Kerry's (Gt. Britain), Ltd.	Ord.	5/-	11/9
Macreadys Metal Co., Ltd.	Ord.	5/-	17/3
Martin Bros. (Machinery), Ltd.	Ord.	2/-	2/6
Massey (B. & S.), Ltd.	Ord.	5/-	12/-
Newall Engineering Co., Ltd.	Ord.	2/-	11/9
Newman Industries, Ltd.	Ord.	2/-	6/3
" "	6% Prf. Ord.	5/-	5/-
Noble & Lund, Ltd.	Ord.	2/-	6/-
Norton, W. E. (Holdings), Ltd.	Ord.	2/-	8/-
Osborn (Samuel) & Co., Ltd.	Ord.	5/-	58/6
" " "	5½% Cum. Prf.	£1	23/-
Pratt (F.) & Co., Ltd.	Ord.	5/-	18/9
Sanderson Kayser, Ltd.	Ord.	10/-	40/-
" "	6½% Cum. Prf.	£1	17/-
Scottish Machine Tool Corporation, Ltd.	Ord.	4/-	12/3
Shardlow (Ambrose) & Co., Ltd.	Ord.	£1	70/-
Shaw (John) & Sons, Wolverhampton, Ltd.	Ord.	5/-	20/3
Sheffield Twist Drill & Steel Co., Ltd.	Ord.	4/-	19/9
" " "	5% Cum. Prf.	£1	14/3
Stedall & Co., Ltd.	Ord.	5/-	8/10½xd
Sykes (W. E.), Ltd.	"B" non-voting Ord.	10/-	32/6
Tap & Die Corporation, Ltd.	Ord.	5/-	19/3
" " "	4½% Deb. 1961-1977	Stk.	82½
Wadkin, Ltd.	Ord.	10/-	26/-xd
Ward (Thos. W.), Ltd.	Ord.	£1	83/-
" "	5% Cum. 1st Pref.	£1	14/-
" "	5% Cum. 2nd Pref.	£1	22/6
Willson Lathes, Ltd.	Ord.	1/-	3/4½

The Middle Prices given in the list are in several cases nominal prices only and not actual dealing prices. Every effort is made to ensure accuracy, but no liability can be accepted for any error. * Sheffield price. ‡ Birmingham price.

PRICES OF MATERIALS

All prices per ton except where otherwise stated.

Pig Iron

Foundry and Forge
No. 3, Class 2

Middlesbrough (10 tons or over)	£21 17 0
Birmingham (10 tons or over)	£21 9 3

Phos. Over 0·1 up to 0·4%

Birmingham (6 ton lots)	£23 5 0
Grangemouth (6 ton lots)	£23 10 0

Hæmatite
English No. 1 (10 tons or over)

N.E. Coast (made in N.E.)	£23 19 0
Scotland	£24 5 6
Sheffield	£25 9 0
Birmingham	£25 13 0
Welsh 10 tons or over	£23 19 0

Steel Products

Medium plates (50 tons and over)	£43 16 6
Mild steel plates, ordinary (50 tons and over)	£40 7 0
Boiler plates (50 tons and over)	£42 17 0
Flat bars, 5 in. wide and under (50 tons or over)	£39 1 0
Round bars, under 3 in. (50 tons or over)	£39 1 0
Billets, rolling quality, soft U.T. (100 tons or over)	£31 15 6

Phosphor Bronze

Ingots (288) (A.I.D.) d/d	£322 0 0

Copper

Cash (mean)	£244 12 6
Cold rolled and hot rolled sheets 4 ft. by 2 ft. by 10 SWG	£320 5 0
Rods, $\frac{7}{8}$ in. to $\frac{1}{4}$ in. diam.	£338 10 0
Tubes, $1\frac{1}{8}$ in. bore by 10 SWG, ton lots, per lb.	3s. 3½d.
Wire rod, black, hot-rolled ($\frac{1}{4}$–$\frac{7}{8}$ in.), English	£261 2 6

Zinc

Refined, minimum 98 per cent purity, current month (mean)	£81 16 3

Brass

Tubes, solid drawn, per lb.	1s. 11½d.
Strip 63/37, 6in. by 10 SWG coils, ton lots	£267 15 0—£270 15 0
Rods, $\frac{1}{4}$–3 in. diam. (59 per cent copper)	2s. 1½d.

Yellow Metal

Condenser plates, per ton	£197 0 0
Rods, per lb.	2s. 2½d.

Aluminium

Ingots, min. 99·5 per cent Canadian d/d	£186 0 0

Tinplates

*U.K. Home trade: Cold reduced, f.o.r. makers works (15-50 tons)	£3 6 8
U.K. Export: Hot rolled basis, f.o.r. works port	73s. 6d.—76s. 0d.
Cold reduced basis, f.o.r. works port	73s. 6d.—76s. 0d.

Gunmetal

Ingots, B.S. 1400 L.G.2, delivered	£232 0 0

* Official maximum price, after allowing for adjustments for increase in price of tin.

MAKERS' PRICES

Hexagon Steel Bars[1]

Sizes in inches from 1 in. up to 2·21 and 2·41 a/f ex works, 2 tons basis	£42 17 0
Free cutting black	£47 6 6

Reeled Steel Bars[1]

Single-reeled, 1½ in. upwards, f.o.t. works (+ usual extra for sizes)	£43 9 6
Free cutting	£47 19 0

Precision-ground Mild Steel[2]

1-in. diam. ± 0·00025-in. 4-ton lots, per cwt.	124s. 6d.

Bright Ground Stainless Steel Bars[3]

EN56AM (martensitic, free cutting)	£304 10 0
EN58AM (austenitic free cutting)	£377 10 0

Prices are basic, subject to extras.

High-speed Steel

Black random length bar. All prices basic, per lb., subject to extras:

Molybdenum "66"	6s. 5d.
Molybdenum "46"	6s. 3d.
14 per cent tungsten	6s. 11d.
16 per cent tungsten	7s. 4d.
18 per cent tungsten	7s. 9d.
22 per cent tungsten	9s. 2d.
5 per cent cobalt	10s. 10d.
4·75/5·25 molybdenum + 6·0/6·75 tungsten + 1·75/2·05 vanadium per cent (5-6-2)	6s. 7d.

Precision-ground, High-speed Free-turning Brass Rod[2]

½-in. diam. ±0·00025-in., 2 ton lots, per lb.	2s. 7½d.

Grey Iron Rod

Die Cast[4] in random lengths 18 in. to 26 in. rough machined $\frac{1}{16}$-in. above listed size. Extra for definite lengths. Discounts for orders over £150.

	Per cwt. net. Mark I	Mark III
¾ or ⅞ in.	260s. 3d.	338s. 3d.
1 or 1¼in.	208s. 4d.	267s. 3d.
1½ to 1¾ in.	146s. 3d.	181s. 7d.
1⅞ to 2 in.	112s. 7d.	133s. 6d.
2¼ to 3¼ in.	97s. 1d.	112s. 9d.
3½ to 12 in.	91s. 9d.	105s. 3d.

Continuous Cast

10-ft. lengths, centreless machined 1 to 3-in. diam. + 0·010 to 0·020 in., prices as quoted for die cast bar[4]		
centreless ground 1 or 1¼ in.		208s. 4d.
+0·010 in. Extra for hardenable alloy iron[5]	1¼ to 1⅝ in.	146s. 3d.
	1⅞in. to 2 in.	112s. 7d.
Per cwt. net	2¼ to 3½ in.	97s. 1d.

Stellite[6]

Welding Rods, plain

¼ in. diam., per lb.	30s. 0d.

Toolbits

¼ in. sq. × 4 in., each	22s. 3d.

[1] Colvilles, Ltd., Glasgow, and 17 Grosvenor Street, London, W.1. [2] Pratt, Levick & Co., Ltd., Chester. [3] Spartan Steel & Alloys, Ltd., St. Stephens Street, Birmingham, 6. [4] Sheepbridge Alloy Castings, Ltd., Sutton-in-Ashfield. [5] "Flocast" Harold Andrews Sheepbridge, Ltd., Halesowen. [6] Deloro Stellite, Ltd., Highlands Road, Shirley, Solihull.

BASIC PRICES FROM LONDON STOCK[4]

Free Cutting Steel

Bright cold drawn: (Usaspead) over 1 to 2 in.	£59 4 6
Lead bearing (Usaled)	£63 11 0
Precision ground, 1⅜ in.	£84 14 6

Bright Drawn

M.S. bars (M.M.C.) over 1¼ to 2 in.	£56 10 0
Square edge flats (Usaflat)	£73 6 6
M.S. angles (Usaspead)	£100 6 6
Case hardening (EN) (Usacase) over 1½ to 2 in.	£62 10 0
M.S. bars (EN3B) (Usamild) over 1½ to 2 in.	£58 16 6
Carbon manganese semi-free cutting case hardening (EN202) (Usaspead 202) over 1½ to 2 in.	£71 5 0
35/45 ton tensile (EN6) (Usen) over 1 to 1½ in.	£67 3 0
0·4 carbon normalized (Usaspead "40") over 1½ to 2 in.	£69 5 0
0·45 carbon normalized EN9 (Usaspead 55)	£69 15 0
Carbon manganese steel to Specification EN16T (Usaspead 5565), per ton	£126 17 0

Ground Flat Stock

18-, 24-, and 36-in. lengths (Usaspeed). List prices plus 10 per cent, less 5 per cent.

Oil Hardening Cast Steel

Non-shrink (Usaspead N.S.O.H.), ½ in. to 2½ in., per lb.	1s. 11d.
Non-distorting heavy duty (Usaspead H.C.H.C.), ½ in. to 2½ in., per lb.	4s. 2d.

Silver Steel

(0·194-in. to 1½-in.) Genuine Stubs quality, per lb.	4s. 10d. less 27½%
M.M.C. quality, per lb.	2s. 8d. + 6½%
Boxes of 16 assorted sizes, $\frac{1}{16}$ in. to ½ in. diam.	7s. 6d.

Stainless Steel

KE40AM (free cutting), per lb.	3s. 8d.

Glacier Machined Bronze Bars

Phosphor bronze (288) } Lead bronze }	Prices on application

High-speed Steel

18 per cent tungsten. Prices on application.
Toolholder bits:

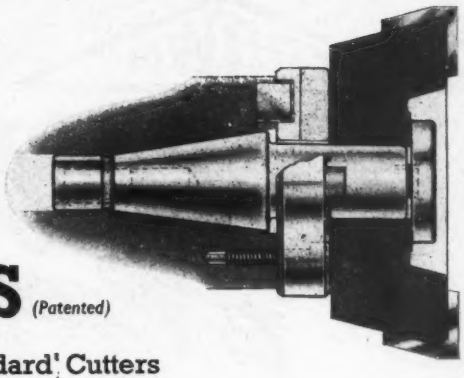
Usaspead "Super" } ,, "Supreme" } ,, Cobalt 10 }	List price

Shimstock

Steel assorted, per tin	3s. 6d.
Brass ,, ,,	7s. 3d.

[6] Macready's Metal Co., Ltd., Pentonville Road, N.1. Subject to confirmation by London Office. Delivered free by van in London area.

J & S -Lunzer FACE DRIVE ARBORS (Patented)



Made to suit all B.S. and American Standard Cutters

Designed for rigid mounting of Facing Cutters : the Sliding Drive Collar is bolted home on spindle face giving full backing to the cutter. Arbor is toughened and ground all over, the Drive Collar is hardened and ground.

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MASTER BAR Jig Borer

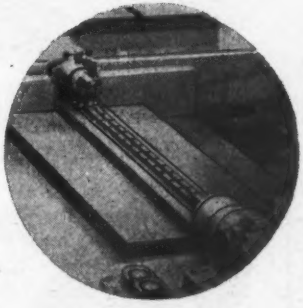
BY BUSWELL & SWEENEY

Rapid, super-accurate setting facilitated by new Master Bar system.. Accurate because it returns to first principles in the use of gauge blocks and large barrel micrometer: rapid because this time-proven method incorporates an ingenious electro-mechanical system which eliminates the handling of blocks and provides automatic power cut-out and table braking when the table is within 0·01 in. to 0·02in. of the required position. Final adjustment is by large diameter handwheel and dial indicator.

Write for full details.

BRIEF SPECIFICATION

Table size: 25in. by 42in.
Longitudinal travel: 30in.
Saddle cross movement: 18in.
Settings to 0·0002in.
Steplessly variable spindle speeds up to 1,800 r.p.m.
Feeds (4) from 0·001in. to 0·008in.
Power setting traverse 60in. per min.
Floor space: 115in. by 115in.



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Re-surfacing to Precision Limits

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GRADE 'A' HAND SCRAPED AND SURFACED TO WITHIN 0·0001in.—0·0003in. FROM A MEAN TRUE PLANE OVER WHOLE SURFACE ACCORDING TO SIZE.

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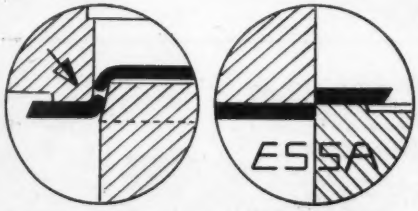

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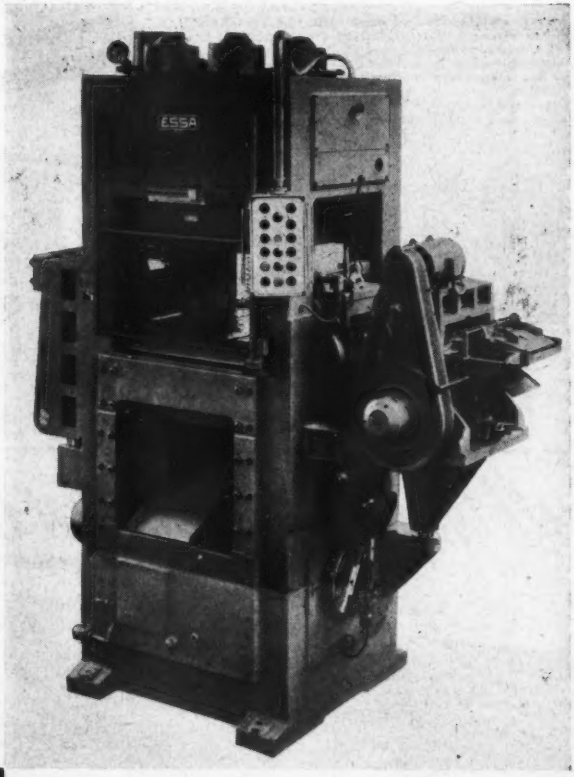

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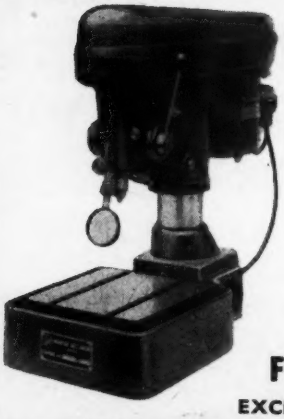

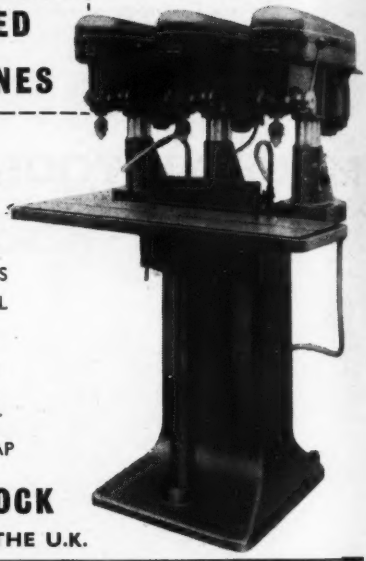

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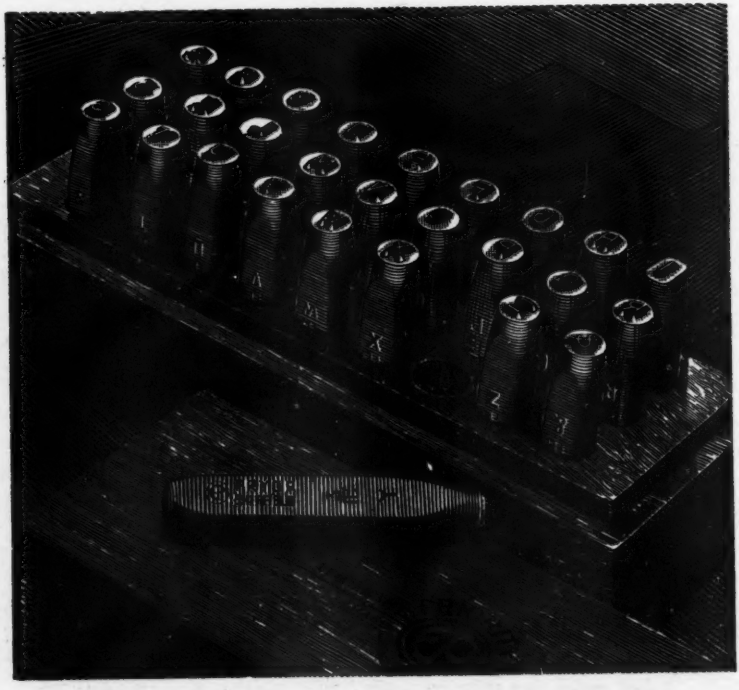

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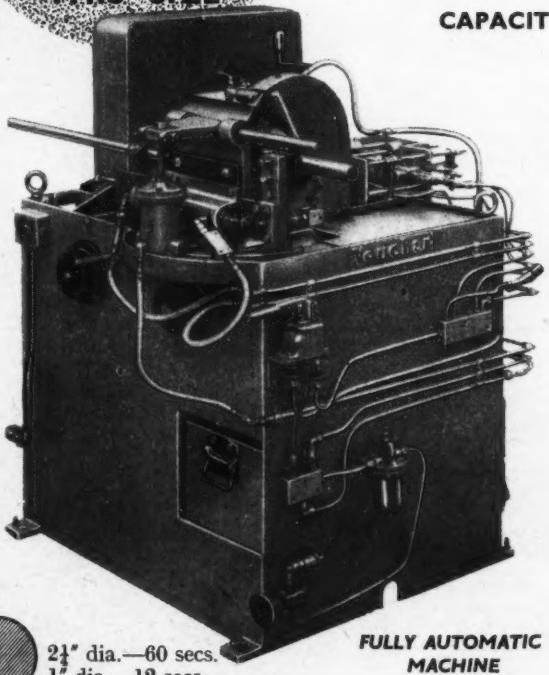

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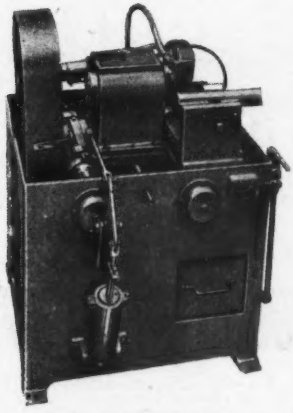

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USED WITH INDEXING TABLE FOR MILLING

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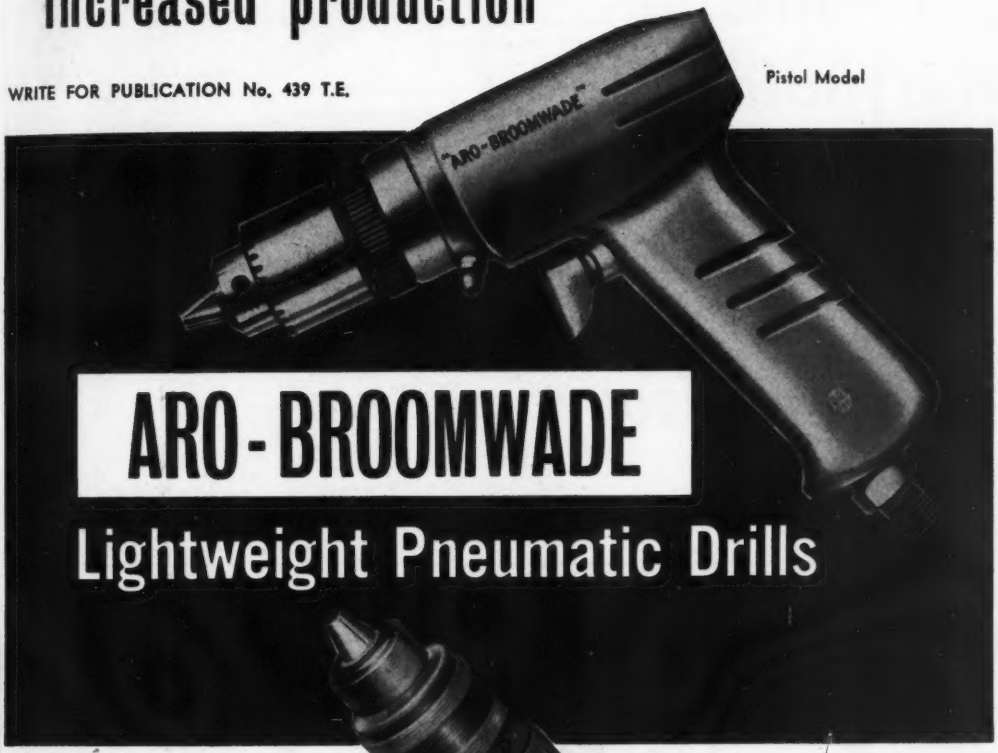

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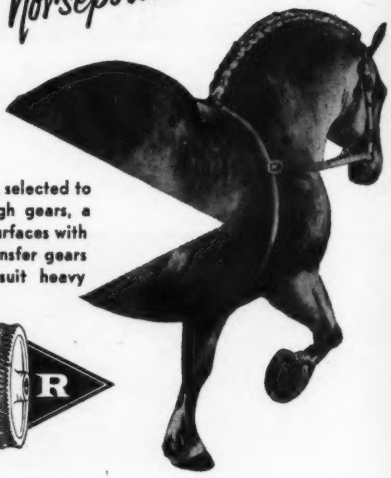

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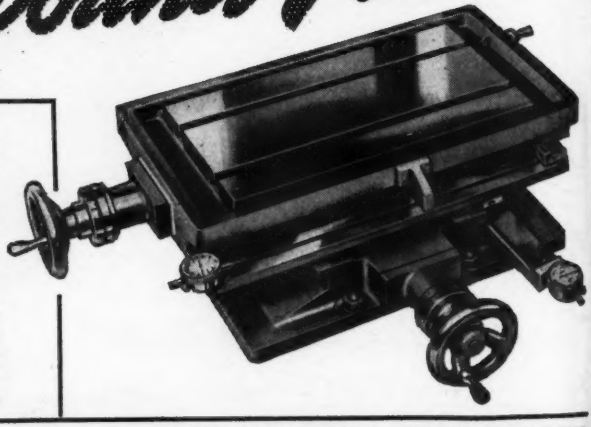

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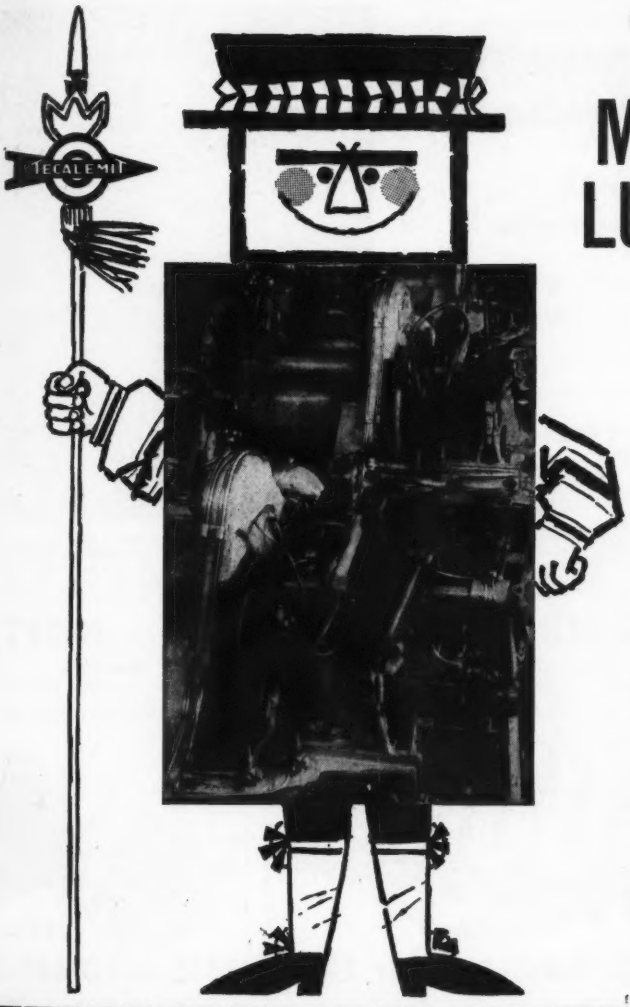

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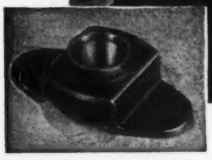

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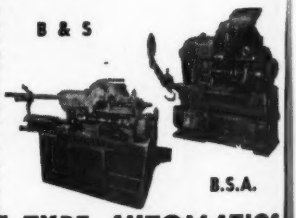

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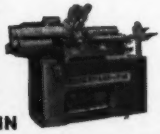
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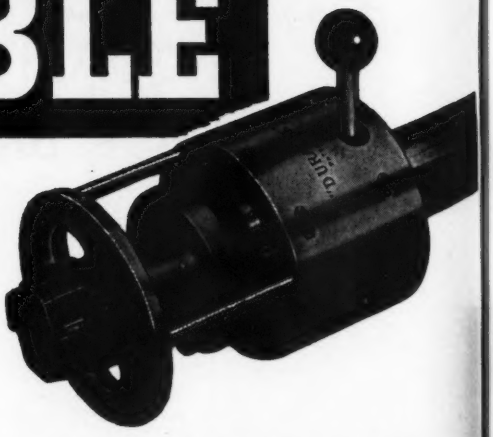

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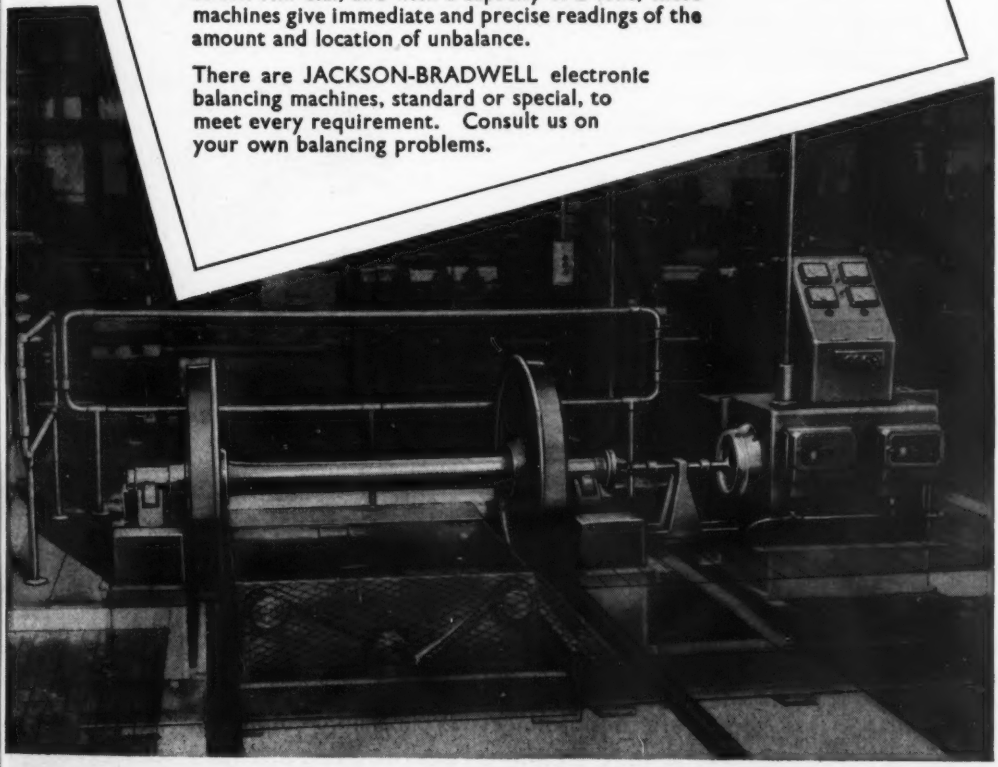

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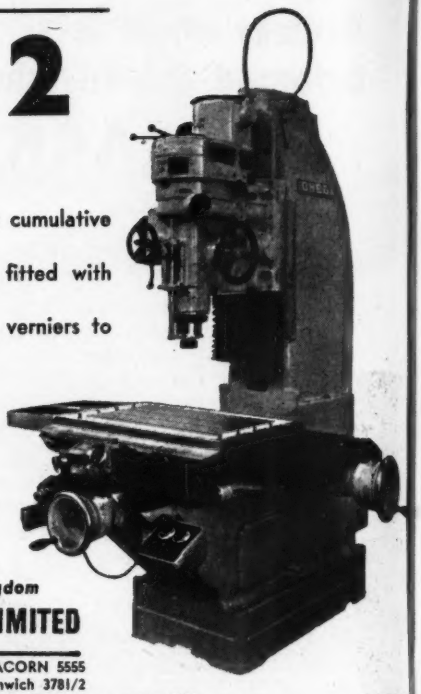

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Spindle speeds (16) 50-2,000 r.p.m.
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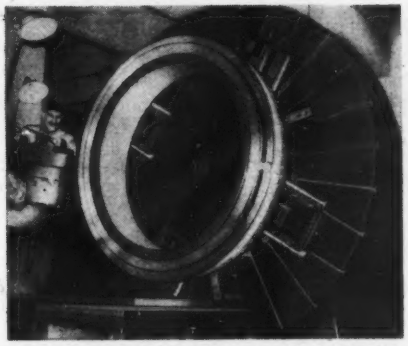
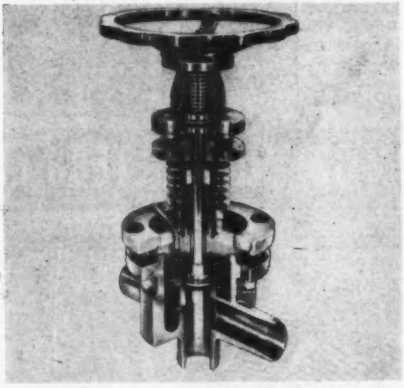
equipment subjected to CORROSION, HEAT and ABRASION



The resistance of "Stellite" to seizure and oxidation, together with its high creep strength is proving invaluable for components used in gas turbines.

Illustration:— Machining "Stellite" faced gas turbine hot ring in the Works of Cantieri del Tirreno, Italy.

"Stellite" is applied by all welding methods and by spray-fusing. It is also available as castings machined to a high degree of accuracy or as precision investment castings.



"Stellite" trim is specified by valve users for applications requiring maximum resistance to heat, corrosion and erosion.

Illustration:— Liquid metal valve with "Stellite" plug designed and developed within the Research and Development Branch of U.K.A.E.A., of Capenhurst. Manufactured by Palatine (Surbiton) Limited.

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The severe abrasive conditions encountered in mines and quarries are successfully combated by facing wearing parts with "Stellite"

Illustration:— Excavating on coal site. "Stellite" is used on bucket edges and teeth

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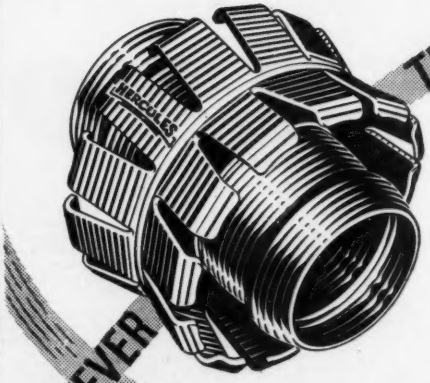

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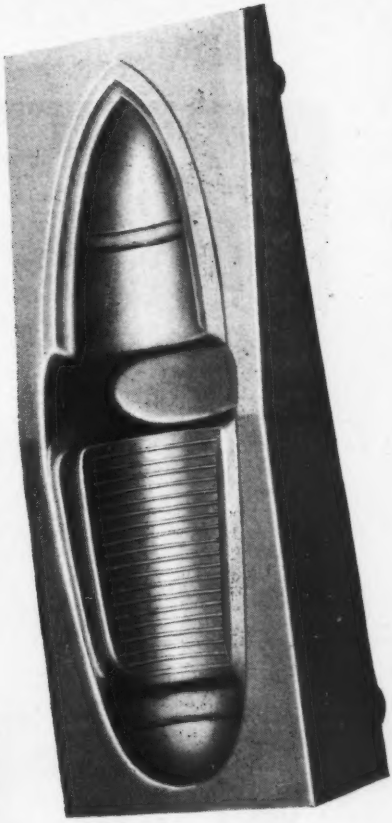

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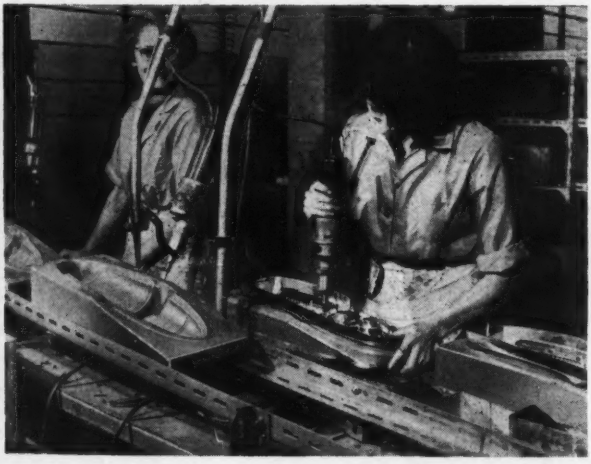

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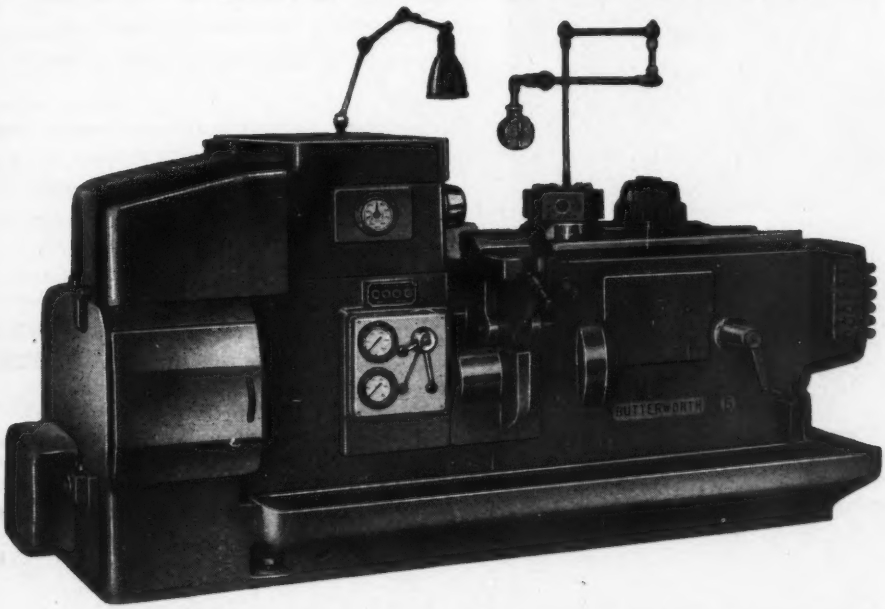

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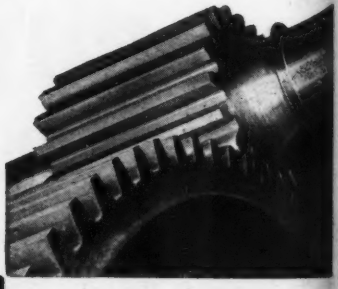

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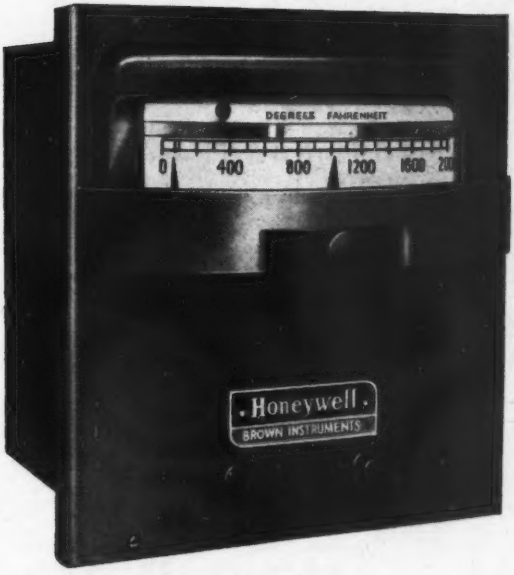

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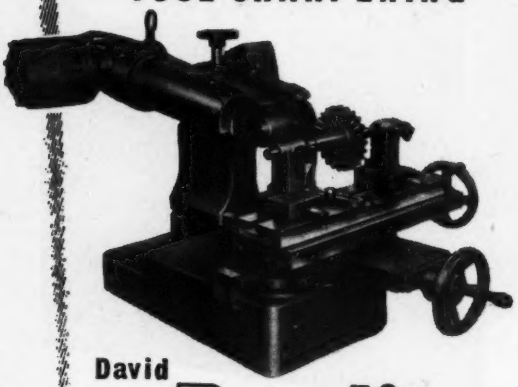

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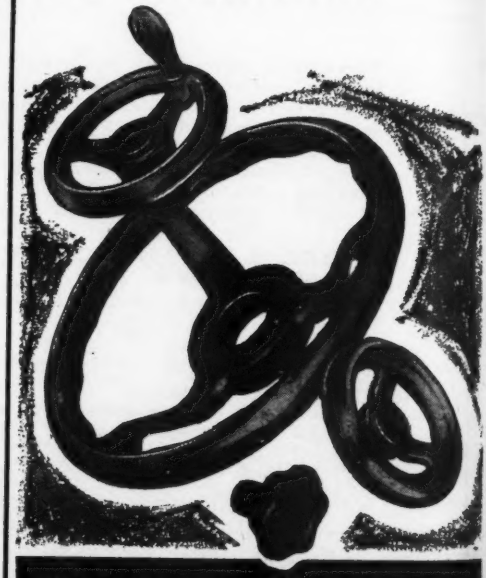

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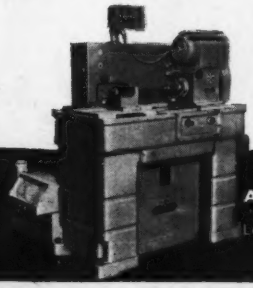

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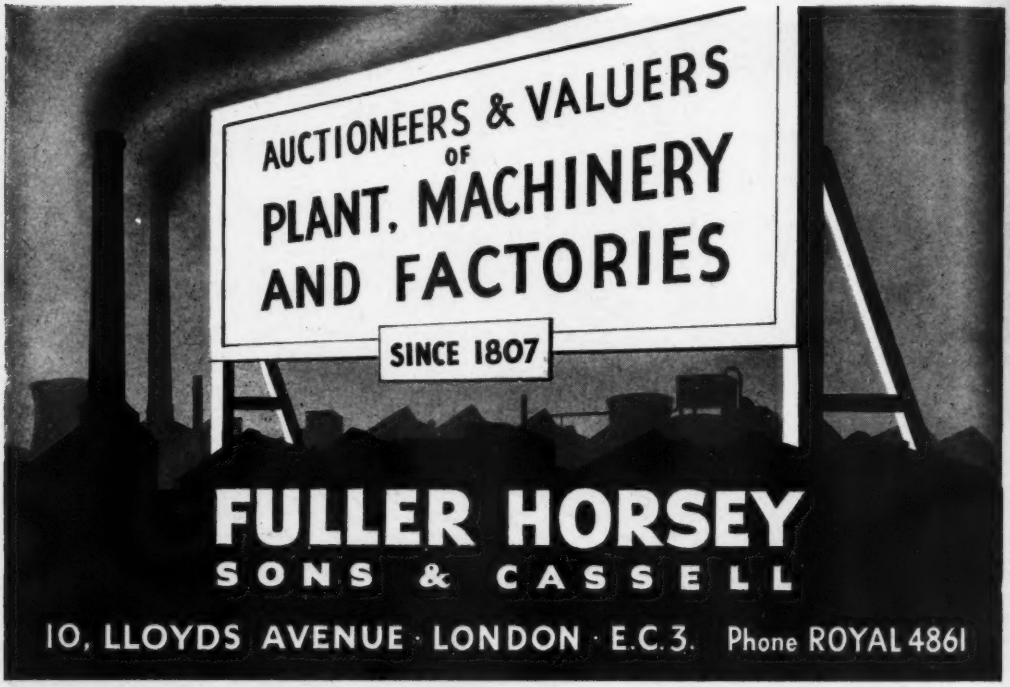

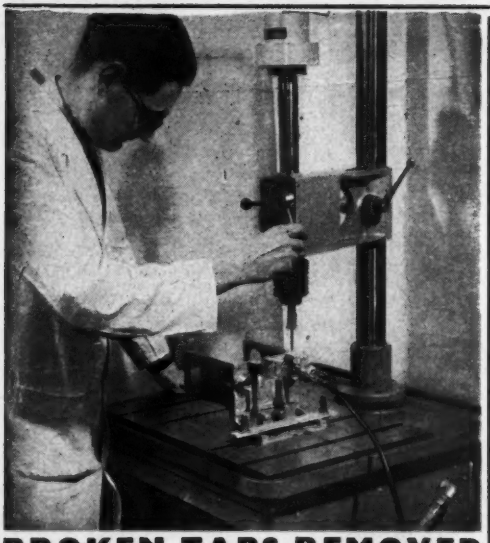

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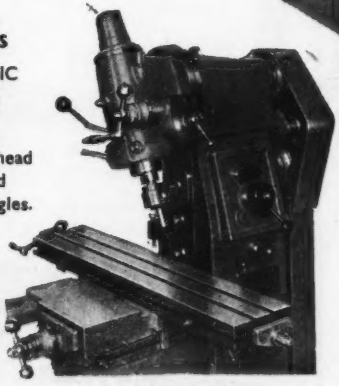

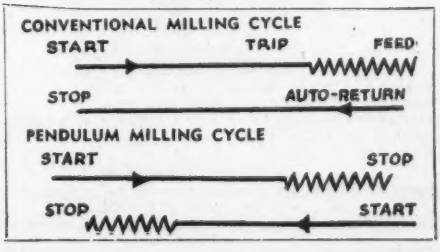

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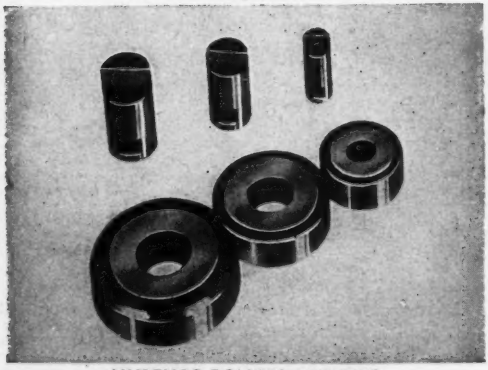

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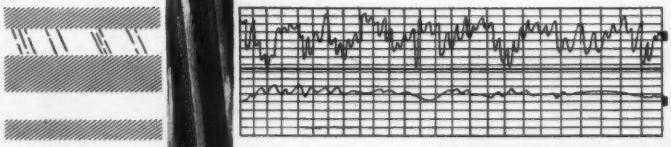

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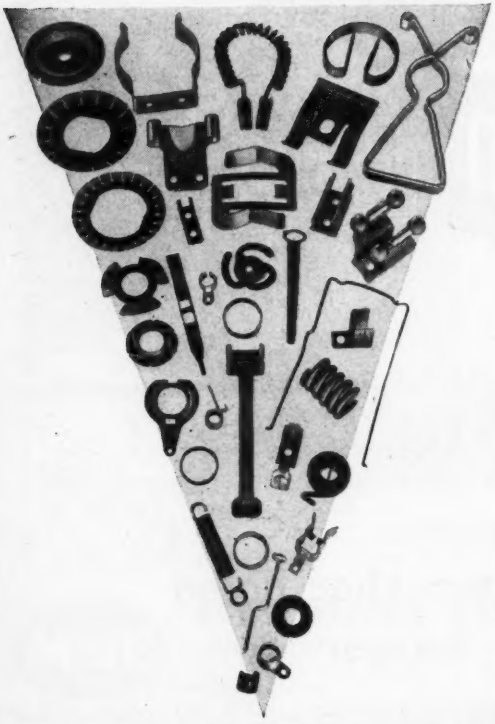

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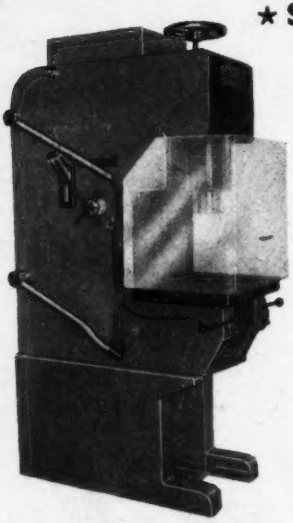

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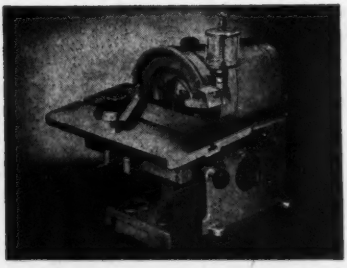

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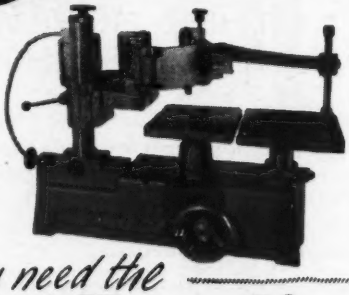

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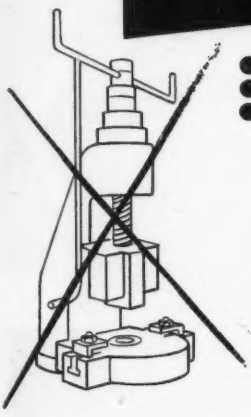

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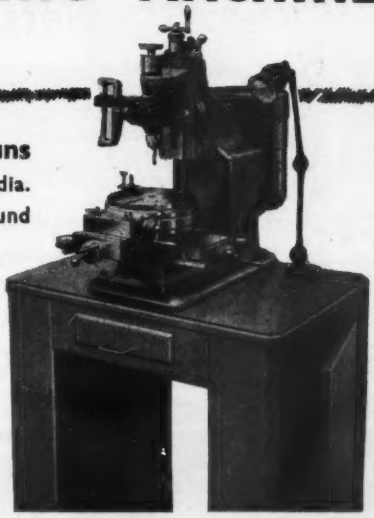

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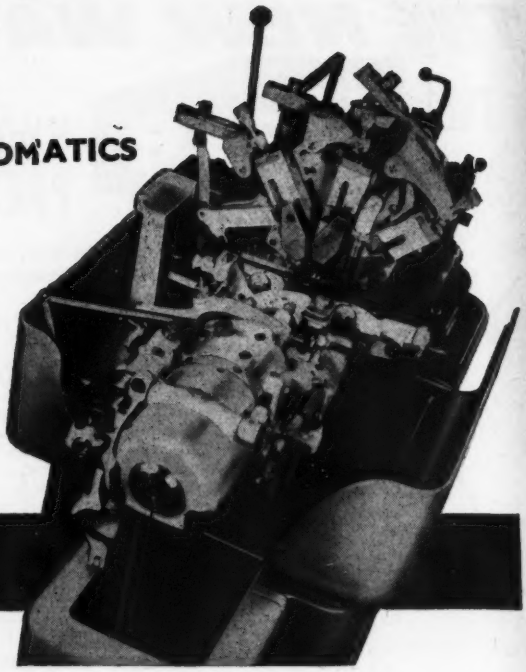

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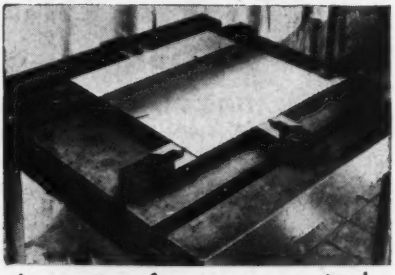

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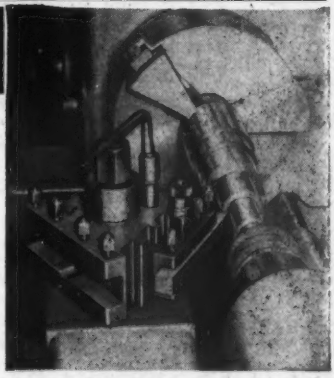

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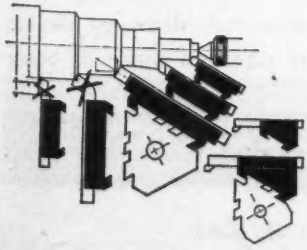

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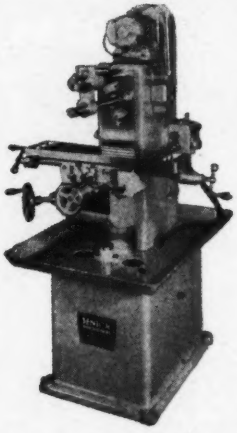

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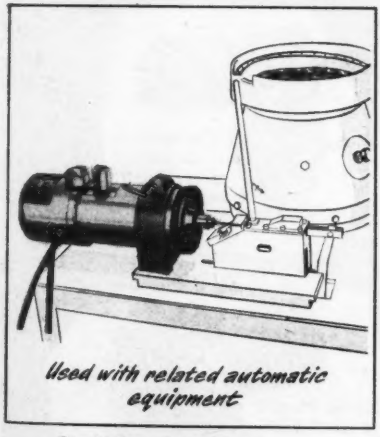

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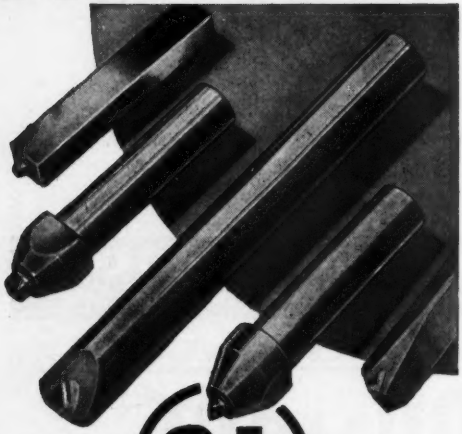

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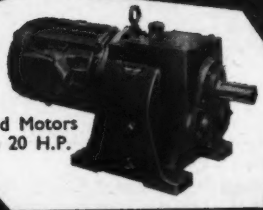

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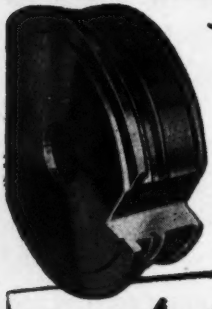

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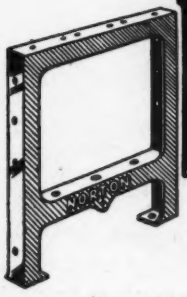

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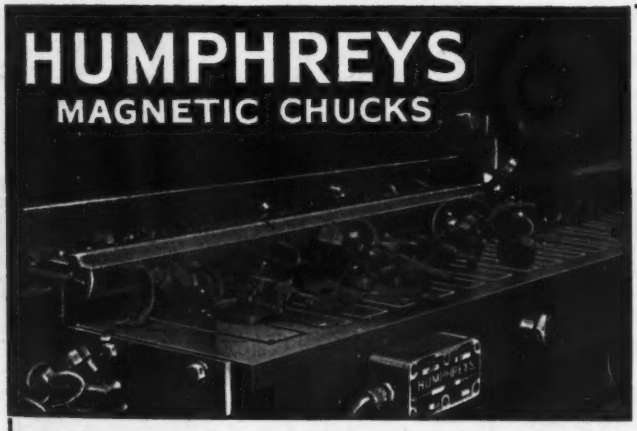

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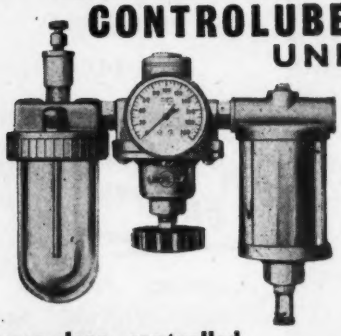

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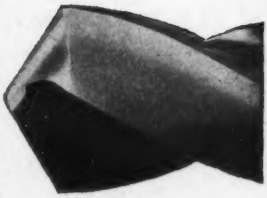

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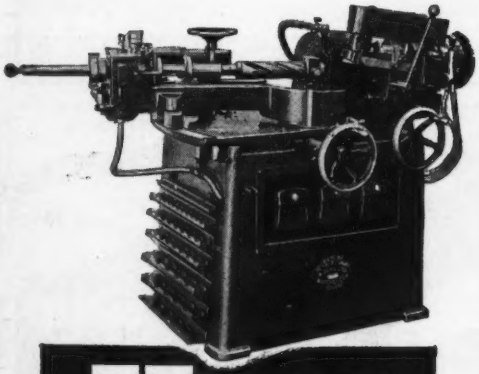

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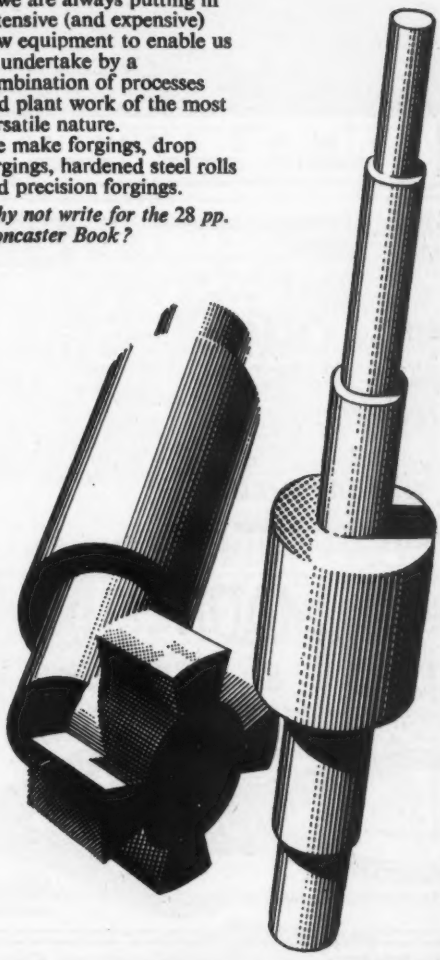

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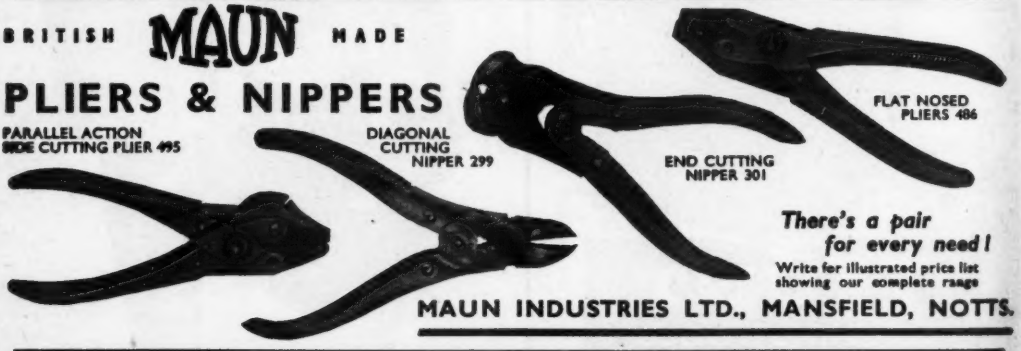

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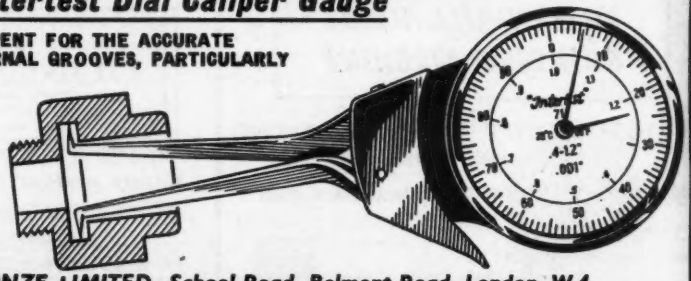

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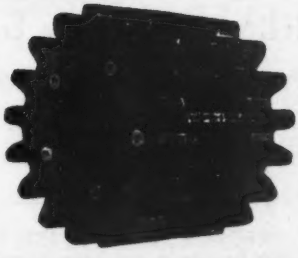

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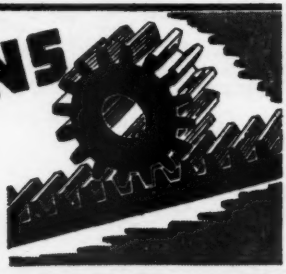

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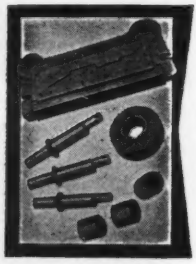

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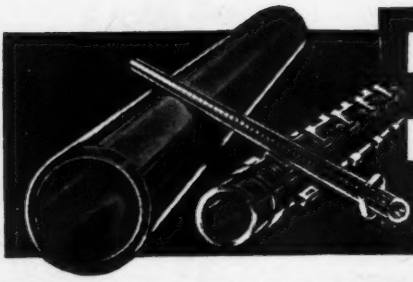

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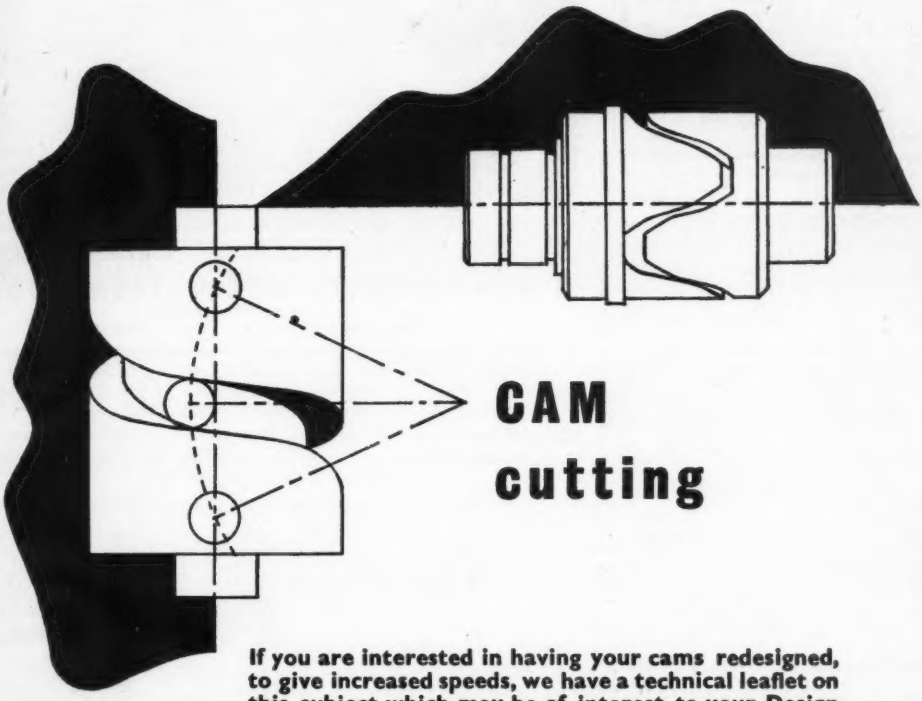

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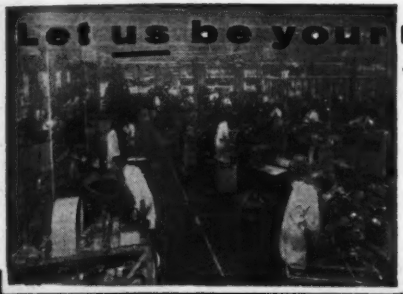

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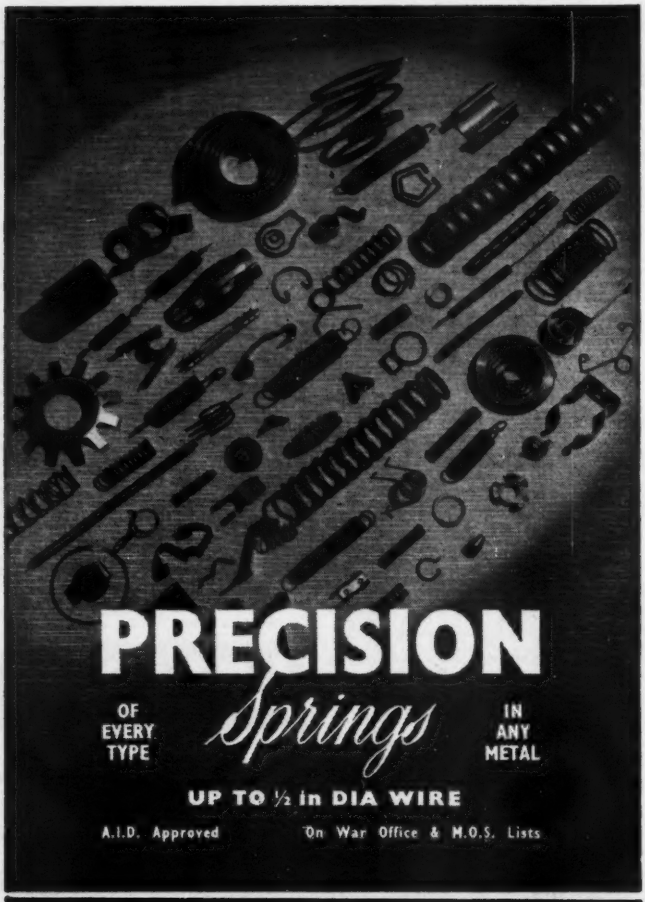

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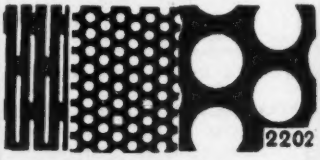

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AJAX 16in. by 4½in. Mill.
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VICTORIA V2 Swiv. Head Mill, 1954.
BULLARD 16in. 6-sp. Mult-Au-Matic, 1943.
GLEASON 12in. Bevel Gear Gen., 1945.
FELLOWS 61A, 645A Gear Shapers.
BRYANT 16-38 Internal Grinder.
HEENAN-FROUDE Baling Pres, 1947.
SCHULER Vertical Dieing Press.
REDMAN 12 × 4 × 4 Planer.
HERBERT 6S Turret Lathe.
MILWAUKEE 2H, 2K, 3H, 3K Millers.
BLISS 304A 50 ton Press, 4in. stroke.
NORTON 14 × 72 Univ. Grinder.
BROWN & SHARPE No. 3 Univ. Grinder.
DEFIANCE 25A Horizontal Borer.
ARCHDALE 38in. Sens. Radial Drill.
NEWALL type L 10in. × 48in. Grinder, 1942.
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BROWN & SHARPE No. 3 Vert. Mill, 1942.
PRATT-WHITNEY 12B 2-sp. Profiler, 1941.
EDGWICK No. 2 Universal Miller.
BARNES No. 2 Horizontal Hones (3).
CHURCHILL No. 1 Planetary Grinder.
ORCUTT HM24 Gear Grinder, 1944.
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GISHOLT 5 and 1L Turret Lathes, 1941-43.
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HELLER Automatic Thread Millers (4).
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WICKMAN 1¼in. 5-Spindle Bar Automatic, well equipped turret tools, collets, bar feed.

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DISKUS Vertical Spindle Surface Grinder. Table 53in. by 10in. Hydraulic feeds, 12in. dia. segmental wheel.

CHURCHILL Model "O" Universal Tool and Cutter Grinder, 8in. by 16in.

EDGWICK No. 1 Keyseating Machine.

BROWN & SHARPE No. 2 Universal Milling Machine. Table W.S. 46in. by 10in. Spindle speeds 30-1,300 r.p.m. Vertical attachment, slotting attachment, universal dividing head, rotary table, etc.

CINCINNATI 0.8 Vertical Milling Machine. Table W.S. 20in. by 6in. Spindle speeds 150 to 1,300 r.p.m.

THREE HERBERT O.V. Vertical Milling Machines, swivel head. Table W.S. 18in. by 5in. Spindle speeds 250-2,000 r.p.m.

ARCHDALE 28in. Plain Horizontal Milling Machine. Table W.S. 49in. by 13in. Power feeds and rapid traverse.

18in. **EDGWICK** Plain Horizontal Milling Machine. Table W.S. 26in. by 7in.

TRIDENT V.O. Swivel Head Vertical Milling Machine, table W.S. 30in. by 8in.

DRUMMOND Model K Capstan Lathe, arranged for chucking. 2 1/16in. Hollow Spindle.

GISHOLT No. 4 Capstan Lathe, arranged for chucking, 2½in. Hollow spindle.

TURNER 1¼in. Capstan Lathe, with bar feed.

TWO HERBERT No. 2B Capstan Lathes, one with bar feed, one arranged for chucking.

HERBERT No. 1S Capstan Lathe, chucking.

KITCHEN & WADE Heavy Duty Vertical Drill. Spindle bored No. 4 M.T. 24in. dia. rise and fall table, swings round column.

TWO HILLE two-spindle drilling machines. Power feed and independent motor to each spindle, fitted ¾in. drill chuck. W.S. Table 21½in. by 9in.

ARCHDALE 6ft. Radial Drill, No. 5 M.T. Tee slotted low base 4ft. by 6ft.

THIEL No. 6 Radial Arm Tapping Machine, ¾in. Whit.

SUPERIOR Vertical Tapping Machine, ½in. Whit.

JONES & SHIPMAN "Electrotap".

ALBA 18in. Crank Shaping Machine.

SIX TURNER Spin Riveting Machines. Type RS5.

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DEAN, SMITH & GRACE 24in. Swing Boring and Surfacing Lathe, 3in. Hollow Spindle. Hexagon turret on compound slide rest.

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GLASS 9½in. by 10ft. 6in. S.S. & S.C. Gap Bed Lathe. 2 1/16in. Hollow Spindle, swing in gap 30in. dia. Admits 6ft. 6in. between centres.

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PEARN-RICHARDS No. 2 Horizontal Boring and Facing Machine. Dia. of facing head 20in. With vernier height gauge and boring bars.

KEARNS No. O.A. Production type Horizontal borer with 2½in. dia. traversing spindle.

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Selection of Machine Tools from Stock

CENTRE LATHES

New **WILLSON** 7¼in. Mark V S.S. & S.C. Lathe to admit 3ft. 0in. between centres.
MITCHELL OF KEIGHLEY 8¼in. S.S. & S.C. Lathe to admit 4ft. 3in. between centres.
MITCHELL OF KEIGHLEY 10¼in. S.S. & S.C. Lathe to admit 4ft. 0in. between centres.
MITCHELL 7in. S.S. & S.C. All-Geared Head Gap Bed Lathe, to admit 3ft. 0in. between centres.
WILLSON 7¼in. S.S. & S.C. Lathe, to admit 3ft. 0in. between centres.
FAIRBAIRN 13in. S.S. & S.C. Lathe with two saddles, to admit 17ft. between centres.
VOLMAN 8in. S.S. & S.C. Gap Bed Lathe, to admit 4ft. 6in. between centres.

BORING MACHINES

WEBSTER & BENNETT 36in. Vertical Boring Mill, table speeds 5.6/125 r.p.m.
WEBSTER & BENNETT 48in. Vertical Boring Mill, table speeds 4-88 r.p.m.

DRILLING MACHINE

New **KITCHEN-WALKER** 4ft. 6in. Radial Drilling Machine, No. 5 M.T. spindle.

GRINDING MACHINES

JONES & SHIPMAN Fig. 540 Horizontal Spindle Surface Grinding Machine, hydraulic feed 6in. × 18in. capacity.
One similar Machine with vertical spindle.
NORTON 6in. × 18in. Horizontal Spindle Surface Grinding Machine with hydraulic feed.
LUMSDEN Model 90LE Vertical Spindle Rotary Table Surface Grinding Machine, with 24in. diameter magnetic chuck.
NORTON 6in. × 30in. Hydraulic Plain Cylindrical Grinding Machine, maximum wheel diameter 20in.

MILLING MACHINES

VICTORIA M.2 Universal Milling Machine, 40in. × 10in. table.
ARCHDALE 20in. Dial Type Horizontal Milling Machine, 40in. × 12in. table.
GREENWOOD & BATLEY Plain Horizontal Milling Machine, working surface of table 20in. by 10in.
EDGWICK 18in. Horizontal Plain Production Milling Machine, with 40in. × 12in. table.
EDGWICK No. 2 Dial Type Vertical Milling Machine, 46in. × 11in. table.

PLANING MACHINE

SWIFT SUMMERSKILL 8ft. × 4ft. × 4ft. Planing Machine with 4 toolboxes, all electric Lancashire Drive.

POWER HAMMER

MASSEY 5 cwt. Pneumatic Side Type Power Hammer.

SLOTTING MACHINES

BUTLER 14in. stroke All Geared Slotting Machine with 39in. diameter rotary table.
DUTRANNOIT 24in. stroke Precision Slotting Machine with swivelling head, 39¼in. table.

SHAPING MACHINES

New **ALBA** 24in. and 18in. stroke Shaping Machines.
BUTLER 18in. Heavy Duty Shaping Machine.

SHEARING MACHINE

New **KEETONA** 8ft. 0in. × ¼in. Undercrank Guillotine Shearing Machine.

STRAIGHTENING ROLLS

BRONX 8ft. 0in. × ¼in. Straightening Rolls 5 roll type.
All the above machines are motorised 400-440/3/50 cycles.

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ASQUITH Portable Radial Drill.
CHURCHILL Hcy Internal Grinder.
LANDIS 10in. × 24in. Universal Grinder.
STANLEY 8¼in. × 48in. S.S. & S.C. Lathe.
ARCHDALE 20in. Horizontal Miller.
ARCHDALE 18in. Vertical Miller.
CINCINNATI 4/36 Hydromatic Miller.
PRATT & WHITNEY Thread Miller, 4¼in. × 12in.

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KERRY Super 8 Pillar Drill.
SPEEDAX Abrasive Cutting Off Machine.
CARDIFF 11in. × 80in. S.S. & S.C. Lathe.
DENBIGH No. 6 Fly Press.
RAPIDOR 6in. Saw.

MACHINE TOOLS AVAILABLE FOR SALE BUT NOT IN STOCK

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BUFFALO 28U Double Ended Punch, Shear and Angle Cropper.
ASQUITH 6ft. Radial Drill with screw cutting attachment.
ORCUTT 24in. Automatic Gear Grinder. New 1957.
LANG 26in. Boring and Facing Lathe.

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Taylor & Challen Power Press, B.3½, 60 ton cap. Adjustable stroke ½-4in. Roll feed and cutter fitted.—BOX C692, MACHINERY, Clifton House, Euston Road, N.W.1.

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PROGRESS 3A 1¼in. Cap. Pillar Drill. (July, 1961)
PROGRESS Multi-Spindle, 2 No. 1—¼in. Cap.; 2 No. 2G—⅜in. Cap. (June, 1961)
RICHMOND HB3/12 4ft. 6in. Arm Radial. (May, 1961)
RICHMOND SR.2 4ft. Arm Radial (May, 1961)

GRINDING MACHINES

MYFORD MG.12 Cylindrical Grinder (Aug., 1961)

LATHES

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CROWTHORNE 7¼in. × 3ft. 6in. b.c. (Aug., 1961)
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RAGLAN 5in. × 2ft. b.c. (Aug., 1961)
STANLEY 8¼in. × 6ft. b.c. (May, 1961)
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SMART & BROWN Model L.16 ¼in. Cap. Capstan. (Sep., 1961)
SMART & BROWN 1024 Precision Toolroom (July, 1961)
WILLSON 7¼in. Newel Mark V × 3ft. b.c. (May, 1961)
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WOODHOUSE & MITCHELL 7in. 70 Junior. (July, 1961)
WYVERN 5WT Combined Centre Lathe and Capstan. (July, 1961)

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DENBIGH D.4 Semi-Universal Horiz. (May, 1961)
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RICHMOND Turret Mill. (July, 1961)
VICTORIA "Juniormil" Plain Horiz. (Aug., 1961)
VICTORIA "Junior Omnimil" Combined Horiz. and Vert. Mill. (Aug., 1961)
VICTORIA Rapidmil Universal No. 2 Mill. (Sept., 1961)
VICTORIA V.2 Vert. Mill. (Aug., 1961)
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VICTORIA TV.1 Turret Mill. (May, 1961)
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STARTRITE 18in. SP.147T Bandsaw. (May, 1961)
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HEALD Internal Model 81

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ARCHDALE 28in. Plain. Power feeds in all directions.
ARCHDALE 20in. Plain, Rapid Production.
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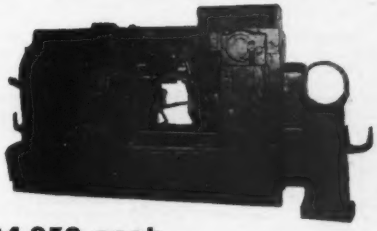

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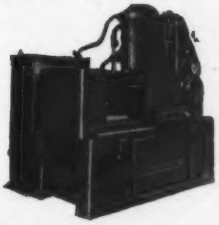

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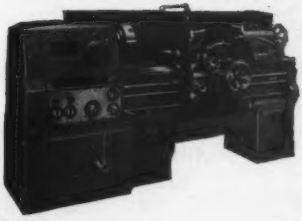

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ASQUITH U.G.D. Vertical Drill. No. 5 M.T. Built 1955.

ARCHDALE 20in. Plain Miller. Speeds to 615 r.p.m.

BLISS No. 18 Inclinable Power Press. Tonnage rating 8. Stroke 2in. M.D. 400/3/50.

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GRAHAM & NORMANTON 20in. Crank Shaper. V-belt drive from 5 H.P. motor, 9 ram speeds.

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KEARNS OA Horizontal Borer. Travelling spindle 2¼in. dia. Facing head 14in. dia. With verniers. M.D. 400/3/50.

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7½in. centres **WILLSON** S.S. & S.C. Lathe, 9ft. 6in. gap bed, 6ft. 6in. between, 2½in. hollow spindle, standard 3 phase electrics.

7½in. centres **TRIUMPH** S.S. & S.C. Lathe, 6ft. 6in. gap bed, 4ft. 0in. between, 1½in. hollow spindle, standard 3 phase electrics.

6in. centres **MASTER** S.S. & S.C. Lathe, 5ft. 6in. gap bed, 3ft. 0in. between, 1½in. hollow spindle, single pulley drive.

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WILSON "Newel" 7½in. Centre Lathe, S.S. & S.C. All Geared Head, Quick Change Gear Box. Distance between centres 32in. 9 spindle speeds 26-477 r.p.m. Motorised 400/3/50. Machine complete with 3-jaw chuck, faceplate, travelling steady.
MILWAUKEE 1H Plain Horizontal Milling Machine. Table working surface 40in. × 9in. Rapid traverse all ways. 16 spindle speeds 35 to 1,400 r.p.m. 400/3/50.
ASQUITH EGC. 6ft. Girder Type Radial Drilling Machine. Spindle Bored No. 5 M.T. 6 spindle speeds 220-905 r.p.m. 4 auto feeds. 400/3/50.
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RHODES No. 12 Double Sided, Double Crank, Geared, Power Press. Pressure 75 tons, fitted fixed stroke 4in. Bed area 44in. × 42in. Motorised 400/3/50.

STANCROFT LTD.,
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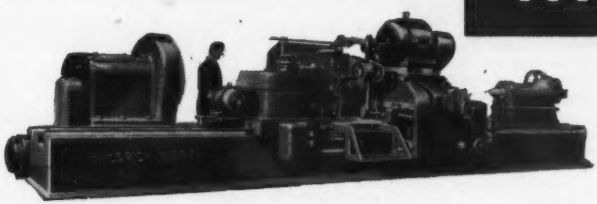
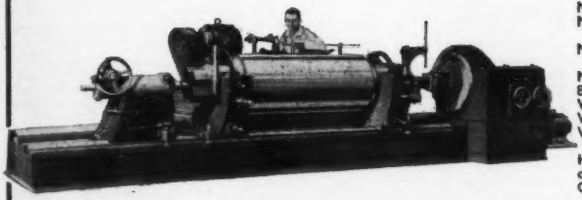
carefully used modern design WALDRICH SIEGEN ROLL GRINDING MACHINE





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Maximum diameter of roll ground	38in.
Maximum length of roll face ground (with heavy duty roll supports in position) ...	8 ft. 4in.
Maximum length of roll face ground (without supports)	13ft.
Maximum distance between centres	13ft.
8 workhead speeds	6-57 r.p.m.
Workhead motor...	10 h.p.
Wheel size	24in. by 3in.
Wheelhead motor	20 h.p.

Headstock has 24in. diameter faceplate, with a special driver for driving the "wobblers" of steel mill rolls. Overall floor space required for the machine is 25ft. by 9ft.

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CRAVEN S.S. & S.C. Centre Lathe, 13½in. centre height × 31ft. 6in. between centres.

MILLING MACHINE

COLLET & ENGLEHARDT Keller Type Die Sinking Machine. Model FKf80, capacity 60in. × 30in.

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CINCINNATI Planing Machine, capacity 8ft. × 2ft. 6in.

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ROCCO Model AL55D Horizontal Boring and Facing Machine, 2½in. dia. travelling spindle. (NEW.)
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HETTNER Radial Drilling Machine, 10ft. elevating arm.

GEAR MACHINES

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GLEASON 3in. Straight Bevel Gear Generator.

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Angle Cropping Machine. Cap. up to 6in. × ½in. angles.

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BULLARD 36in. Vertical Borer, Rules, Tool Holders, etc. 400/3/50. £950.
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ROLLO 6½in. Centre Lathe.
SWIFT Hydraulic Copying Lathe, 36in. swing × 5ft. 6in. b.c., 30 h.p. drive.
HENDY 13in. × 30in. S.C. Lathe.
RIVET 4in. × 18in. b.c. Precision Lathe.
LE BLOND 14in. × 24in. S.C. Lathe.
BOLEY LEINEN L.4 2nd Operation.
WARNER & SWASEY No. 3 Capstan

MILLERS

ARCHDALE 48in. Heavy Duty Automatic Horizontal Mill, speeds 38-313.
CINCINNATI 1-18 Production Miller.
KENDALL & GENT Vertical Miller, table 69in. × 19in., speeds 20-300, rapid traverses.
BROWN & SHARPE No. 2 Vertical Mill, table 54in. × 14in., speeds 30-1,200 r.p.m. Power down feed to head.
SCHIESS DEFRIES Vertical Keyseater.
MAMMUT 10in. × 23in. Table Horizontal Mill, hand lever operated.
FRITZ WERNER 10in. × 34in. Horizontal Mill.
BROWN & SHARPE No. 2 11in. × 49in. Horizontal Mill, speeds 15-376. Feeds 3/10-15 I.P.M.

PRESSES, SHAPERS, PLANERS AND HOBBERS

CHURCHILL-REDMAN 32in. Stroke Heavy Duty Shaper. Excellent condition.
ESSEX No. 32 Punch Shaper.
30-ton **RASKIN** Double Sided Double Geared Drawing Press. Area 20in. × 23in. Draw 4½in.
MAXICUT High Speed Gear Shaper, max. dia. 7in. × 2in. face.
New **POREBA** Model HDA.80 Planer, capacity 10ft. × 32in. × 30in. table, drive by Heid gearbox.
DOWDING V8 Gear Hobber. Max. pitch in steel one cut 14 D.P.; in soft metals one cut 12 D.P. Max. dia. 0in.-8in. No. of teeth cut 6-400. Length of hobbing traverse 7½in. Hob spindle speeds (10) 61-246 r.p.m.

DRILLS

BOLEY Multi Drill VB 10in.
CORONA 13in. 2AP Sensitive Pedestal Drill.
CORONA 20in. Pedestal Drill.
15HEF 4 Spindle Drill.

MISCELLANEOUS

CANNING Double Ended and Centreless Polishing Machines.

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BROACHING
AMERICAN Model H2, stroke 3pin.
CAPSTANS
HERBERT 2S.
MURAD ⅜in.
HERBERT 4B.
DRILLS
DENBIGH 24in. B.G.
HERBERT " C " Power Feed.
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JONES & SHIPMAN 816, ⅞in. cap.
CORONA IAX, No. 1 Morse Taper.
CORONA 15HF, ⅝in. cap.
LELAND GIFFORD 2-sp., No. 2 M.T.
HERBERT Type B. Single Spindle, ¼in.
CORONA 6MX Cluster Type.
HERBERT Type H, ¼in. dqp.
CORONA 12AX, ⅞in. cap.
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LIENHARD 3 Dimensional (New).
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HUPFIELD Router.
T.T. & H. Type C, C.B. and M.A.
T.T.& H. Multi Etcher.
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Wicksteed No. 1 Hacksaw.
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RAPIDOR Filing.
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GEAR CUTTERS
SAFAG Pinion.
MAXICUT 7in. × 2in. × 6 D.P.
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SNOW Table, 20in.
ABRASIVE No. 34 Vertical Spindle.
ABRASIVE No. 1½in. hand.
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GRINDERS (Cylindrical)
CHURCHILL 6 × 36in. B.Y.
CHURCHILL PBH 12 × 36in. Uni.
NEWALL 6 × 18. Model XL.
PRECIMAX MPB 10 × 48.
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JONES & SHIPMAN, 10in. × 27in., T. & C.
J. & S. Drill, ¼in. to ¾in.
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TAUCO 10in. Abrasive Cut Off.
ROWLAND 12in. × 2in. Single Wheel.
ABWOOD Carbide.
WICKMAN NIVEN Carbide.
WADKIN Saw Sharpener.
JACKMAN D/E 18in. Disc.
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NEWALL 420 Univ. Threads for taps.
HUNT No. 0 and 1 Tap Regrinders.
HUNT No. 0 and 2 Drill.
CHURCHILL Valve.
HONER
DELAPENA 4-speed.
KEYSEATERS
BENTLEY 5in.
ASQUITH H.K.O. Horiz. Duplex.
EDGWICK 4in.
LATHES
DENHAM 4½in. × 24in. S.S. & S.C.
LE BLOND Production, 11in.
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WILLSON 7½in. S.S. & S.C.
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MARKING MACHINE
FUNDITOR " Sand Jet."
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LUKE & SPENCER 38in. × 4 HP Polisher.
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" LINISHER " A4, 36in. × 4in.
MILLERS (Horizontal)
ADCOCK & SHIPLEY No. 0. Table 12×4½.
CINCINNATI 1/18 Production.
DENBIGH Type C4. Table 46 × 10.
ROSCHER EICHLER. Table 39in. × 12in.
ST. ANDREA Model UFO3. Table 57 × 14.
KENT OWEN 1/8 Production.
HARDINGE Precision. Table 25 × 6½.
WERNER. Table 14 × 5.
JONES 225 Univ. Table 22 × 6.
ARCHDALE 20in. dial. & 14in. mfg.
RICHMOND O3. Table 40 × 10.
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MILLERS (Vertical)
C.V.A. 79 Tool and Die.
PALLAS VI. Table 30 × 8½.
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MILNE. Table 30in. × 8in.
WADKIN Type LXIA. Table 36in. × 13in.
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LECRA No. 8. 4 tons.
WRIGHT Clicking Press.
SCHULER VZZ. 15 tons d/s gripper feed.
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CURDNUBE 2 Spindle. Model KIV.
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HIGH SPEED Hammer, 7/16 cap.
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NEWEY 14in.
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GSP 9½in.
EDGWICK.
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ACE Horiz., ¼in. capacity.
J. & S. Electrotap, ¼in.
THREAD MILLERS
JONES FB1, 4ft. between centres.
WICKMAN MOULTON 1B.

Norton Universal Grinding Machine. 1942. Size 12in. × 36in. Condition good. External/internal equipment.—BOX C679, MACHINERY, Clifton House, Euston Road, N.W.1.

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Two brushes and two paraffin sprays.
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Motor drive, 50 h.p. 400/440/3/50.
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Brown & Sharpe OOG Single- spindle Automatic for sale, series 15,000. Also C.V.A. No. 8 ditto. Electrics 400/3/50.—BOX C876, MACHINERY, Clifton House, Euston Road, N.W.1.

36in. Lang All-geared S.S. & S.C. Chucking Lathe with taper turning attachment. 30in. four-jaw chuck. 36in. between chuck and saddle. 20 h.p., 400/3/50 motor. 12 speeds 8.5-403 r.p.m. Spindle bored 2¼in. dia. Timken roller bearings.—LEE & HUNT, LTD., Crocus Street, Nottingham. 'Phone: 84246.

Index Model OR12, ON12 and O High Speed Single Spindle Automatics, 400/3/50.—HICKS MACHINERY, LTD., 26, Addison Place, London, W.11. Tel.: PARk 2333.

SOAG WARD No. 16 COMB. TURRET LATHE

Capacity:
Swing over bed 35in.
Swing o/cross slide 25¼in.
16 sp. speeds from 7-225 r.p.m.
Spindle bore 3¼in.
Dist. spindle to turret face 99in.
H.P. motor 50.
Arranged for chuck work and screwcutting.
This is a 1948 machine, well maintained and in sound condition. Inspection invited.

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Classified Advertisements (*PLANT FOR SALE, contd.*)

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PARKSON Model 2J Universal *MILLING MACHINE*. Table size 4ft. 3in. × 11½in. 12 spindle speeds 17 to 450 r.p.m. Power traverses to all table movements. With vertical attachment. Motor drive 400/3/50 Price: £875

SWIFT SENTINEL Type 8SG 9in. all Geared Head Gap Vee Bed S.S. & S.C. *CENTRE LATHE*. Admits 6ft. between centres. Spindle speeds 30 to 1,000 r.p.m. Fitted with enclosed feed gear box. Motor drive 400-440/3/50. Price: £1,100

KITCHEN & WADE 3ft. 6in. Low Base Radial *DRILLING MACHINE*, with elevating arm. Spindle bored No. 4 Morse Taper. Spindle speeds 80 to 1,500 r.p.m. Power feed to spindle. Tee slotted base 3ft. 6in. × 3ft. With loose box table. Motor drive 400-440/3/50. Price: £650

JONES & SHIPMAN Model 1001 Type EN Plain Cylindrical *GRINDING MACHINE*. 12in. swing × 27in. between centres. Hydraulic table traverse. Separate motor drive to workhead giving speeds 40 to 320 r.p.m. Motor drive 400-440/3/50. Price: £1,275

INVICTA Model 2M 14in. stroke Crank *SHAPING MACHINE*. 6 speeds to ram 12 to 110 s.p.m. Working surface of box table 14in. × 10in. top face, 11in. × 11in. side face. Motor drive 400/3/50. Price: £285

CLEVELAND Model "A" 1 5/16in. Single Spindle Bar *AUTOMATIC*. Max. bar capacity 1 5/16in. Max. turning length 3¾in. Spindle speeds by pick-off gears 235 to 1,275 r.p.m. Five station circular turret. Motor drive 400/3/50. Price: £525

WARD Model 10/13 Combination *TURRET LATHE*, with covered bed. Spindle speeds 16 to 470 r.p.m. Power feeds to saddle and turret. Arranged for chuck work. Chasing to saddle. Motor drive 400-440/3/50. Price: £1,800

COLCHESTER MASCOT 8½in. All Geared Head S.S. & S.C. Gap Bed *CENTRE LATHE*. Admits 4ft. 6in. between centres. 2in. hollow spindle. 8 spindle speeds 25 to 410 r.p.m. Quick change gear box. With taper turning attachment. Motor drive 400/3/50. Price : £700

KENT OWENS Model 1-18 Horizontal Production *MILLING MACHINE*. Table size 25in. × 9in. Spindle speeds by pick-off gears 75 to 1,000 r.p.m. Hydraulic table traverse. Motor drive 400/3/50. Price: £175

DEAN, SMITH & GRACE 15in. All Geared Head S.S. & S.C. *STRAIGHT BED LATHE*. Admits 17ft. between centres. 3⅛in. dia. hollow spindle. 16 spindle speeds 3·19 to 343 r.p.m. Motor drive 400/3/50. Price: £1,150

FOSDICK Jig *BORING MACHINE*. Table size 36in. × 18in. Spindle speeds 45 to 1,125 r.p.m. Arranged for clocks and measuring rods. Motor drive 400/3/50. Price: £1,850

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HAGO H.G.25 High Efficiency, ¾in. cap. £250

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PALLAS No. 2 Surface, 18in. × 6in.
HERBERT HUNT Twist Drill Grinder. £65.
HERBERT HUNT Tap and Reamer. £65.
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DARLING & SELLERS 10¼in. × 12ft. T/T.
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OLDFIELD & SCHOFIELD 15in. × 60in. £650.
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RIVET Instrument Lathe, 4½in. × 24in.

MILLERS (Vert. and Horiz.)

RICHMOND 0.1 Horizontal 30in. × 8in.
CENTEC No. 3R Auto-cycle, pro mill.
HEY Duplex Spline Mill. £175.
ADCOCK & SHIPLEY IVM Vert. 25in. × 7in. As new.

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BESCO 10 ton Power Press. £175.
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KENNEDY 2in. Tube Bender. £85.

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BARBER & COLMAN 15in. Hobber.
THIEL Filing and Sawing Machine. £95.
HURTH Key Seating Machine. £225.
THIEL Punch Shaper.
ORMEROD 12in. Shaper with Cam Cutting Attach.
AEROGRAPH Twin Cylinder comp. 100 p.s.i.
MATHEY Jig Borer with clocks. As new.
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Other machines in stock.

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Landis 10in. × 24in. Type "C" Universal Grinder. Internal Attachment. New condition.

Further details from:—
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Landis 12in × 36in. External/ Internal Grinding Machine with Excello Internal Spindle. Chucks and steadies. Good condition. If interested telephone Mr. GANDER, Byfleet 43252.

No. 2 Wickman Horstman Thread Grinding Machine. Form relieving. Fully motorised.—BOX C738, Machinery, Clifton House, Euston Road, N.W.1.

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COLCHESTER "Triumph," 7in. × 48in. Gap S.S. & S.C.
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SMART & BROWN 4in. × 18in. S.S. & S.C.
SWIFT 12in. × 12ft. S.S. & S.C. Heavy Duty R/trav. to saddle.
LANG 36in. Surfacing and Boring.
ACME No. 5W Capstan, chuck machine.
RYDERMATIC No. 12 Multi-Tool.
D.S.G. 13Z Minor S.S. & S.C.
WILLSON 6½in. × 36in. Gap Bed S.S. & S.C.

CAPSTANS AND AUTOS

WARD No. 7 (Curran Sub-Contract).
TAYLOR No. 1263 Capstan, ¾in. cap.

DRILLS

CORONA 3M Pillar, 1½in. cap.
KITCHEN & WADE 2ft. 6in. Radial, 2in. capacity.
CORONA Model 9FX Super High Speed Bench.
CORONA Model 12AX Bench, 5/16in. cap.
BRISDON Model 52 Pillar, ¾in. cap.

GRINDERS

KEIGHLEY KN Internal.
GRAND RAPIDS No. 35 Hyd. Hor. Spin. Surface.
HERBERT JUNIOR Surface, 10in. × 6in. × 9in.
BROWN & SHARPE No. 5 Surface.
BROWN & SHARPE No. 23 Plain, cap. 10in. × 48in.
BROWN & SHARPE No. 2 Surface, cap. 6in. × 18in.
SMART & BROWN Internal, 1½in. cap.
BROWN & SHARPE No. 5, 3in. × 18in. Plain.
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NEWALL Model L.U. 10in. × 36in. Hyd. Universal.
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SNOW Mod. O.S.72 Surface, cap. 15in. × 72in.
CHURCHILL Mod. H.C.B. Internal Auto Size.
HAHN & KOLB Hyd. Disc Lapping M/c.
JACKMAN No. 22 Disc. 18in. dia.
LUMSDEN Mod. 12M Tool, 14in. × 2 wheel.

MILLERS—Vertical

REED PRENTICE Mod. 3VG, table 38in. × 10¼in.
CINCINNATI Model 08 Production.
KENDALL & GENT Duplex Profile, table 18in. × 15in.

MILLERS—Horizontal.

BROWN & SHARPE No. 000 Plain Auto Miller.
BROWN & SHARPE No. 2 Universal light type.
ADCOCK & SHIPLEY No. 1 AB Plain, table 26in. × 7in.
RICHMOND 2HS Plain, table 35in. × 9in.
ARCHDALE 20in., table 40in. × 10in.
ASQUITH H.K.1 Duplex Keyway, table 43in. × 10in.
CINCINNATI Mod. O.K. Prod., table 34in. × 12in.
ARCHDALE 14in. Plain, table 27in. × 8in.
ARCHDALE 28in. Plain, table 49in. × 13in.

BORING MACHINE

KEARNS Mod. O.C. Horizontal, 3in. dia. spindle.

SAWING MACHINES

EHJ No. 13 Filing and Sawing.

SHAPERS

TOWN 14in.
HERBERT N.D. 20in.
ORMEROD 14in.

GEAR CUTTER

MAXICUT Gear Shaper, Mod. No. 2.

MISCELLANEOUS

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HEAP 2in. Screwing Machine.

Classified Advertisements (*PLANT FOR SALE, contd.*)

F. J. Edwards Ltd

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BUTLER 12in. Shaper.
ALBA 14in. and 10in. Shapers.
INVICTA 30in. Shaper, swivel table. (New.)
BROOK 24in. Shaping Macine, swivel table and auto hold down feed. (New.)
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ORMEROD 12in Spline Shaping Machine.
TORPEX 10in. Shaping Machine.
ORMEROD 26in. Stroke Traversing Head Shaper; one head, two tables (1953).

TAPPING MACHINES

JONES & SHIPMAN "Electrotap" Vertical Tapping Machine, leadscrew control with auto cycle for depth, reverse and stop, 1¼in. stroke, 200 r.p.m.

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NEW **SWEDISH** Precision Horizontal Boring Machines, 3in. and 3½in. travelling spindle; with facing head and screwcutting motion. (Sole British Agents.)
KEARNS OB Horizontal Borers, with screwcutting motion, covered bed, spindle 2¾in.
GIDDINGS & LEWIS No. 0 Horizontal Boring, Milling and Drilling Machine, 3¼in. traversing spindle, table 45¼in. × 27¼in.
RICHARDS No. 2 H.T. Hydrabore Universal Boring, Facing, Milling, Drilling and Tapping Machine, with increased bed length and column height; 3in. travelling spindle, 1955 machine.
RICHARDS HB2 Horizontal Boring, Milling, Drilling and Tapping Machine, 2¼in. spindle, screwcutting motion.
WEBSTER & BENNETT 36in. Vertical Borer.

CAPSTAN AND TURRET LATHES

WARNER & SWASEY 3A Turret Lathe, 4¼in. hollow spindle, 23¼in. dia. swing over bed covers.
HERBERT No. 12 Combination Turret Lathe roller bearing spindle, covered vee bed, swing over bed 23¼in., hollow spindle 6¼in. dia., good equipment, chasing saddle with automatic sliding and surfacing feeds.
No. 12 **RYDERMATIC** Three Slide Vertical Multitool Lathe; maximum swing 20in., maximum length 16in., vertical slide stroke 8in., horizontal slide stroke 5½in.
HERBERT No. 21 Combination Turret Lathe, swing 28in. over the bed, 7¼in. hollow spindle, chasing saddle with automatic sliding and surfacing feeds.
HERBERT No. 7 Combination Turret Lathes, hollow spindle 2⅜in. dia., 16in. swing, speeds 18-366 r.p.m.
LIBBY 4A Capstan Lathe, 2¼in. hollow spindle, 20¼in. swing, speeds 27-725.
WARD No. 7 Combination Turret Lathe, 14¼in. swing, 2¼in. hollow spindle, speeds 13-520, r.p.m., chasing saddle, ball chuck.
HERBERT Model 2S Capstan Lathe, collet capacity 1¼in. dia., 11in. swing, ball chuck and bar feed, speeds 28-2,100.

[DRILLING MACHINES

HERBERT 7ft. Radial Drilling, Tapping and Boring Machine, spindle No. 5 M.T., 20in. dia. column. Weight approx. 8 tons.
TOWN 5ft. Radial Drilling Machine, spindle No. 5 M.T., speeds 26-580 r.p.m.
TOWN 4ft. 6in. Radial Drilling and Tapping Machine, Model AE4, No. 5 M.T. (New.)
CINCINNATI BICKFORD 36in. Radial Drilling Machine, spindle No. 4 M.T.
SEGIC (Swedish) 17in. Radial Drilling Machine, 1¼in. capacity, speeds 80-890 r.p.m. (New.)

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WARD 2A Bar and Chuck Machine.
LANG 10in. × 60in. S.S. & S.C. Straight Bed Centre Lathe.
Two **STEINEL** Model SH4D Horizontal Milling Machines.
ADCOCK & SHIPLEY No. 3 Plain Mill, with vertical attachment.
DENBIGH C4 Plain Miller, with adapted motor drive.
COVENTRY Matrix 21 Thread Grinder.
ASQUITH 3½in. Floor Borer, spindle speeds 5.6-350. Screw cutting 3-12 t.p.i.
CHURCHILL 20in. × 84 Plain Grinder with throw blocks for crankshaft grinding.
PROGRESS 4E Pillar Drill.
TRIDENT 18in. × 6in. Surface Grinder.
SCHUTTE Model WU4 20 × 6 capacity, hydraulic automatic feed to table.
JONES & SHIPMAN 4in. × 10in. Semi Universal Grinder.
RICHMOND MV1 Vertical Miller.
ADCOCK & SHIPLEY 2V Vertical Miller.
PEARN RICHARDS Horizontal Borer, 28in. dia. facing head rapid traverses and screw cutting.
HILLE 1¼in. Capstan.
SMART & BROWN ⅛in. Capstan.
150 ton 10ft. Press Brake, with Fraser Mono Radial. 30 h.p. pumping unit.
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WICKMAN MOULTON ATM1 Thread Miller. Max. dia. milled 6in. external, 7¼in. internal. Distance work and cutter spindle 24in.
HULLER UG3 Radial Arm Tapper.

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Cincinnati No. 2 Plain Horizontal Milling Machine, Dial type. Med. speed. Dual controls. 3-way Rapid Power Traverse.—BOX C702, MACHINERY, Clifton House, Euston Road, N.W.1.

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Butler 8in. Slotter, Capacity 8in. stroke, 20in. dia. table, electrics 400/3/50. Excellent condition.—BOX C846, MACHINERY, Clifton House, Euston Road, N.W.1.

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INDEX TO ADVERTISERS

	PAGE
Abbey Heat Treatments Ltd.	143
A.B.M.T.M. Ltd.	15
Abwood Machine Tools Ltd.	23
Acbars Ltd.	131 & 158
Aircraft Unit Eng'g. Co.	146
Airmec Ltd.	18
Alexander Bros.	144
Alfa-Laval Co. Ltd.	71
Alleyne Foster Eng. Co. Ltd.	147
Almco Supersheen Division of G.B. Ltd.	45
Archdale, James & Co. Ltd.	34
Ashtead Engineering Co. Ltd.	144
Atkin, W. T. (Tottenham) Ltd.	149
Aurora Gearing Co. (Wilmot North) Ltd.	114
Auto Screw Products Ltd.	144
Automation Limited	35 & 133
Avenue Engineering Co., The	147
Baker, John & Sons Ltd.	128
Balfour, Arthur & Co. Ltd.	17
Ballinger, L. J. H. Ltd.	127
Barber & Colman Ltd.	*Inside Back Cover*
Baty, J. E. & Co. Ltd.	174
Bell, H. (Machine Tools) Ltd.	155, 162 & 170
B.E.N. Patents Ltd.	138
Benson Verniers Ltd.	112
Benton Engineering Co. Ltd., The	144
Blay, Heliot Ltd.	165
Bliss, E. W. (England) Ltd.	31
Boneham & Turner Ltd.	104
Bowers Internal Gauge Co. Ltd.	124
Bowmaker, Ltd.	33
Brasshouse, Peter Ltd.	14
British Precision Diamond Tools Ltd.	46
British Timken: Division of the Timken Roller Bearing Co.	19
Bronx Engineering Co. Ltd.	131
Broom & Wade Ltd.	101
Brown, David Corporation (Sales) Ltd., The	*Front Cover*
Brown's Engineering Works	147
B.S.A. Tools Ltd.	91
Buck & Hickman Ltd.	26 & 135
Bullows, Alfred & Sons Ltd.	92
Burdett, G. W. S. & Co. Ltd.	115
Burton, Griffiths & Co. Ltd.	91
Buswell & Sweeney Ltd.	93
Butcher, Henry & Co.	154 & 170
Butterworth British Automatic Machine Tool Co. Ltd.	113
Carobronze Ltd.	140
Cashmore, John Ltd.	160
Catmur Machine Tool Corporation Ltd.	3
Centaur Tool Works	158, 163 & 170
Centec Machine Tools Ltd.	121
CIBA (A.R.L.) Ltd.	111
Cincinnati Milling Machines Ltd.	20 & 21
Clarkson (Engineers) Ltd.	53
Coals, F. Ltd.	96
Cohen, Geo. Sons & Co. Ltd.	168
Coventry Grinders, Ltd.	148
Coventry Machine Tool Works Ltd.	32
Crawford Collets Ltd.	29
Cross Manufacturing Co. (1938) Ltd.	128
Croydon Tool & Case Hardening Specialists Ltd.	143
Dawson Bros. Ltd.	*Back Cover*
Delancey Tool & Engineering Works Ltd.	144
Deloro Stellite Ltd.	109
Desoutter Bros. Ltd.	62
Dimco (Gt. Britain) Ltd.	164
Doncaster, Daniel & Sons, Ltd.	139
Donovan Electrical Co. Ltd., The	150
Douglas, A., Co. Ltd.	153 & 160
Dowding & Doll Ltd.	7 & 137
Dowling, David Ltd.	118 & 126
Drummond-Asquith Ltd.	63 & 79
Dunlop Rubber Co. Ltd.	56
Duplex Electric Tools Ltd.	138
Durable Tools Ltd.	106
Eagle Milling Co. Ltd.	142
Easterbrook, Allcard & Co. Ltd.	123
Eclipse Foundry & Engineering Co. (Dudley) Ltd.	143
Economic Stampings Ltd.	147
Edmonton Tool & Eng'g. Co. Ltd.	148
Edwards, Albert (Machinery) Ltd.	152 & 158
Edwards, F. J. Ltd.	154, 155, 165, 167, 169, 170 & 172
Elgar Machine Tool Co. Ltd.	5, 108 & 156
Elliott, B. (Machinery) Ltd.	9 & 157
English Abrasives Corp. Ltd.	8
Etchells, David (Machinery) Ltd.	106
Evans, Fredk. W. Ltd.	144
Ex-Cell-O Corporation (Machine Tools) Ltd.	60
Ferodo Ltd.	87
Ferris, J. & E. Ltd.	138
Fletcher Miller Ltd.	64
Forrest, W. & Co. Ltd.	154 & 165
Forst Broach Co. (G.B.) Ltd.	58
Frye Machine Tool Co. Ltd.	153 & 169
Fuller, Horsey, Sons & Cassell	120
Funditor Ltd.	50
G.A. Precision Products Ltd.	147
Gate Machinery Co. Ltd.	166
General Eng'rs Supply Co. (1937) Ltd.	150
Gidley (Machinery) Ltd.	154

(Continued on page 174)

INDEX TO ADVERTISERS—*(continued from page 173)*

	PAGE
Gisholt Machine Co.	75
Glass Fibre Fabrications Ltd.	90
Godfrey, R. E. Ltd.	129
Goodyear Industrial Rubber Products Ltd.	52
Goodyear-Blackburn Ltd.	112
Granby, Paul & Co. Ltd.	84 & 85
Grapel, H. Ltd.	150
Gray, R. O.	159
Grimston Electric Tools Ltd.	102
G.R.M. Heat Treatments Ltd.	143
Grosvenor Works (Holloway) Ltd.	149
Habit Diamond Tooling Ltd.	39
Hammond Eng'g. Co. Ltd., The	151
Hare, P. J. Ltd.	129
Harvey-Hood Eng'g. Co. Ltd.	142
Heliot	158 & 160
Herbert, Alfred Ltd.	11 & 13
High Frequency Heat Treatment	142
High Speed Service Tool Co. Ltd.	143
Highbury Metal Spinning Co. (1955) Ltd.	147
Hill, John & Sons (Ironfounders) Ltd.	108
Hilmor Ltd.	114
Hobrough Bros. Machine Tools Ltd.	163
Hockley Chemical Co. Ltd. The	76
Holbrook Machine Tool Co. Ltd.	1
Holly Engineering (Drayton) Ltd.	149
Holmes, Percy (Engrs.) Ltd.	150
Holroyd, John & Co. Ltd.	68
Honeywell Controls Ltd.	117
Humphreys, J. H. & Sons, Ltd.	137
Hunt, Herbert & Sons Ltd.	139
Huntley & Sparks Ltd.	144
Hurlock, Wm. Jnr. Ltd.	154
Ide, C. F. Engineering Ltd.	140
Ideal Hardening Co. Ltd.	143
Ina Needle Bearings Ltd.	48
Jackson & Bradwell Ltd.	107
J.B. Machine Tool Co. Ltd.	153 & 157
Johansson, C. E. Ltd.	70
Jones, A. A. & Shipman Ltd.	93 & 119
Jones & Attwood Ltd.	135
Jones, E. H. (Machine Tools) Ltd.	152 & 155
Keeton, Sons & Co., Ltd.	81
Keir, Alan Ltd.	142
Kelly, R. & Sons Ltd.	157 & 162
Kemp Precision Tooling Ltd.	148
Kemworthy Jig & Press Tool Co. Ltd.	149
Kendall & Gent Ltd.	15
K.E.N.T. Machinery & Engineering Co.	158
Kingsland Engineering Co. Ltd.	157
Kirk, Harry Eng'g. Ltd.	164
Kitchen & Wade Ltd.	49
Landen (Engineers) Ltd	141
Lattimer, E. R. Ltd.	146
Lawrence, A. & Co. (Machine Tools) Ltd.	154 & 157
Layton, M. C. Ltd.	153
Lees Hall & Sons Ltd.	143
Lester-Browne Machine Tools Ltd.	126
Lewis, Frank & Co. (London) Ltd	126
Liberty Eng'g. Supplies Ltd.	156
Low Moor Alloy Steel Works Ltd., The	27
MacDowall Equipment Co. Ltd.	148
MacEchern & Co. Ltd.	141
Machine Shop Equipment Ltd.	122
Machine Tool Sales (London) Ltd.	97
Magnal Products Ltd.	118
Marley, W. H. & Co. Ltd.	*Inside Back Cover*
Marsden & Shiers Ltd.	147
Marsden, W. G. Engineering Ltd.	144
Martin Bros. (Machinery) Ltd.	160
Martonair Ltd.	16
Maun Industries Ltd.	140
Maysmith Eng'g. Co. Ltd.	149
Meddings, W. J. Ltd.	61 & 73
Mek-Elek Engineering Ltd.	128
Melbourne Eng. Co. Ltd.	104
Mercantile Credit Co. Ltd.	69
Microfinish Ltd.	144
Midland Machine Tool Co., The	166
Millen, Edwin & Sons Ltd.	152 & 168
Mills Engineering Products Ltd.	156
Mills, George (Engineers) Ltd.	143
Mills, James Ltd., The Exors. of	*Inside Front Cover*
Modern Machine Tools Ltd.	165
Monks & Crane Ltd.	28
Morris, B. O. Ltd.	55
Mortimer Engineering Co. Ltd.	140
Mortimer Machine Tool Co. Ltd.	47
Moser Cams & Tools Ltd.	136
Mulhead Eng'g. Co. Ltd.	89
Murray's (Pretoria) Eng'g. Co. Ltd.	122
Naish Bros. & Co. Ltd.	148
Neill, James & Co. (Sheffield) Ltd.	72
Nettlefold & Moser Ltd.	38
Newall Group Sales Ltd.	51
Newall Used Machine Division	155
Newman Industries Ltd.	153 & 164
Newton Sales Co. Ltd.	110
Nielsen, F. C. & Son	151
Norton Industries Ltd.	127
Norton, T. & Co. Ltd.	136
Norton, W. E. (Machine Tools) Ltd.	161
Novogage Ltd.	143
O.K. Trading (B'ham) Factors Ltd.	149
Olivers Socket Screws Ltd.	134
O-Vee Spring Gauges Ltd.	100
Park Gate Iron & Steel Co. Ltd., The	105
Phillips, J. W. & C. J. Ltd.	140
Philplug Ltd.	33
Pidgen Bros. Ltd.	161 & 173
P.M.T. (Machine Tools) Ltd.	77
Pocklington & Johnson Ltd.	150
Polarcold Ltd.	147
Polistor Ltd	152
Pollard, Fredk. & Co. Ltd.	78
P.R. Motors Ltd.	102
Precision Gear Machines & Tools, Ltd.	54
Precision Heating Ltd.	142
Precision Products (Romford) Ltd.	141
Price, J. T. & Co. (Brass & Aluminium Founders) Ltd.	59
Pryor, Edward & Son Ltd.	98
Raistrick, J. E. Ltd.	153
Ratcliffe, F. S. (Rochdale) Ltd.	116
Ratcliffe Tool Co. Ltd.	124
Rayner, Peter Ltd	134
Redcar Eng'g. Co. Ltd.	146
Reilly Engineering Ltd.	156
Ritchie, A. H. & Co. Ltd.	151
R.J.H. Tool & Equipment Co. Ltd., The	120
Rockwell Machine Tool Co. Ltd.	41 & 42
Rodger Setterington & Ptrs.	141
Rodgers Bros. Ltd.	138
Roth, L.	154
Rubert & Co. Ltd.	120
Rye, Claude Bearings	150 & 154
Sanderson Bros. & Newbould Ltd.	8
Sandvik Swedish Steels Ltd.	32
Sciaky Electric Welding Machines Ltd.	4
Senior, Tom (Liversedge) Ltd.	126
Seton Creaghe Engineering Ltd.	141, 143 & 144
Shand, J. H. Ltd.	122
Shardlow Micrometers Ltd.	110
Sheepbridge Equipment Ltd.	26
Sheffield Twist Drill & Steel Co. Ltd., The	30
Shelmerdine & Mulley Ltd.	146
Shindler Engineering Co. Ltd.	94
Shirlaw, Allan & Co.	176
Slingsby, Walter & Co. Ltd.	146
Smith, J. & H. Ltd.	122
Smith & Netherwood Ltd.	146
Soag Machine Tools Ltd.	167 & 169
Solex (Gauges) Ltd.	93
Southern Engineering & Machinery Co. Ltd.	152
Spear & Jackson Ltd.	33
Spectra Chemicals Ltd.	96
Speed Tools Ltd.	169
Spring Steel Productions Ltd.	124
Square D. Ltd.	24 & 25
Stancroft Ltd.	153, 162, 166 & 170
Stead, J. & Co. Ltd.	6
Stedall Machine Tool Co.	97
Stephens, R. & Son Ltd.	141
Sykes Machine Tool Co. Ltd.	97
Tate Machine Tool Co. Ltd.	163 & 171
Taylor, Chas. (Birmingham) Ltd.	96
Tecalemit Ltd.	168
Thomson, J. & Son (Gears) Ltd.	96
Times Machinery Co. Ltd., The	98 & 136
Trevena & Glover Ltd.	146
Try, Gordon Ltd.	96
Turner Bros. Asbestos Co. Ltd.	116
Unbrako Socket Screw Co. Ltd.	125
Universal Ball Bearing Co.	149
Van Moppes, L. M. & Sons (Diamond Tools) Ltd.	96
Van Moppes, S. L. Ltd.	134
Vaughan Associates Ltd.	94
Vaughan, F. E. Ltd.	120
Victa Engineering Co.	123
Visual Planning Systems Ltd.	120
Voucher Ltd.	96
Vulcascot (G.B.) Ltd.	120
Ward, M. (Machine Tools) Ltd.	153 & 169
Ward, Thos. W. Ltd.	169
Ward, Wm. & Son (Sheffield) Ltd.	74
Weatherall, A. & Co. Ltd.	149
Webster & Bennett Ltd.	92
Welsh Metal Industries Ltd.	99
West Bromwich Spring Co. Ltd., The	99
West Green Tool Co.	149
Widdowson, Herbert & Sons Ltd.	65, 66, 67 & 154
Wilkinson Machine Tools Co.	155
Williams, H. & Son Ltd.	153
Windley Bros. Ltd.	96
W.J.L. (Machinery) Ltd.	151
Worson Die Cushions Ltd.	138
Zephyr Cams Ltd.	149

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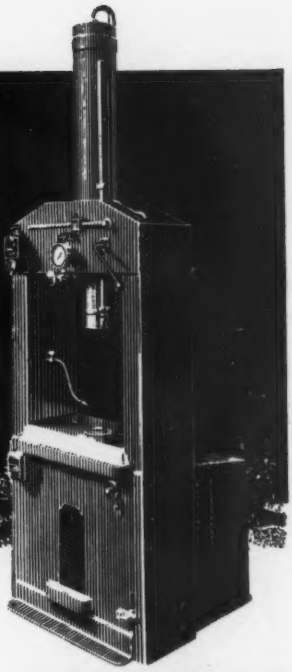

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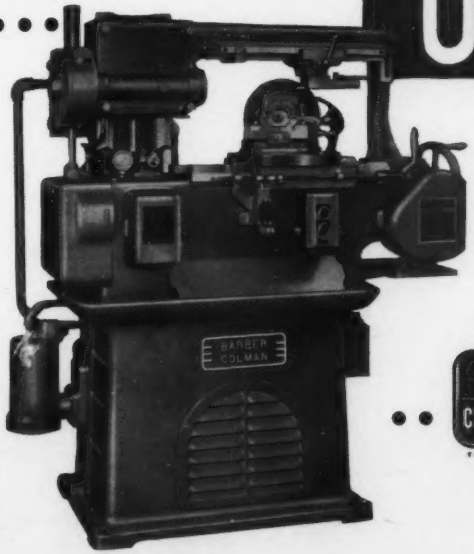

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